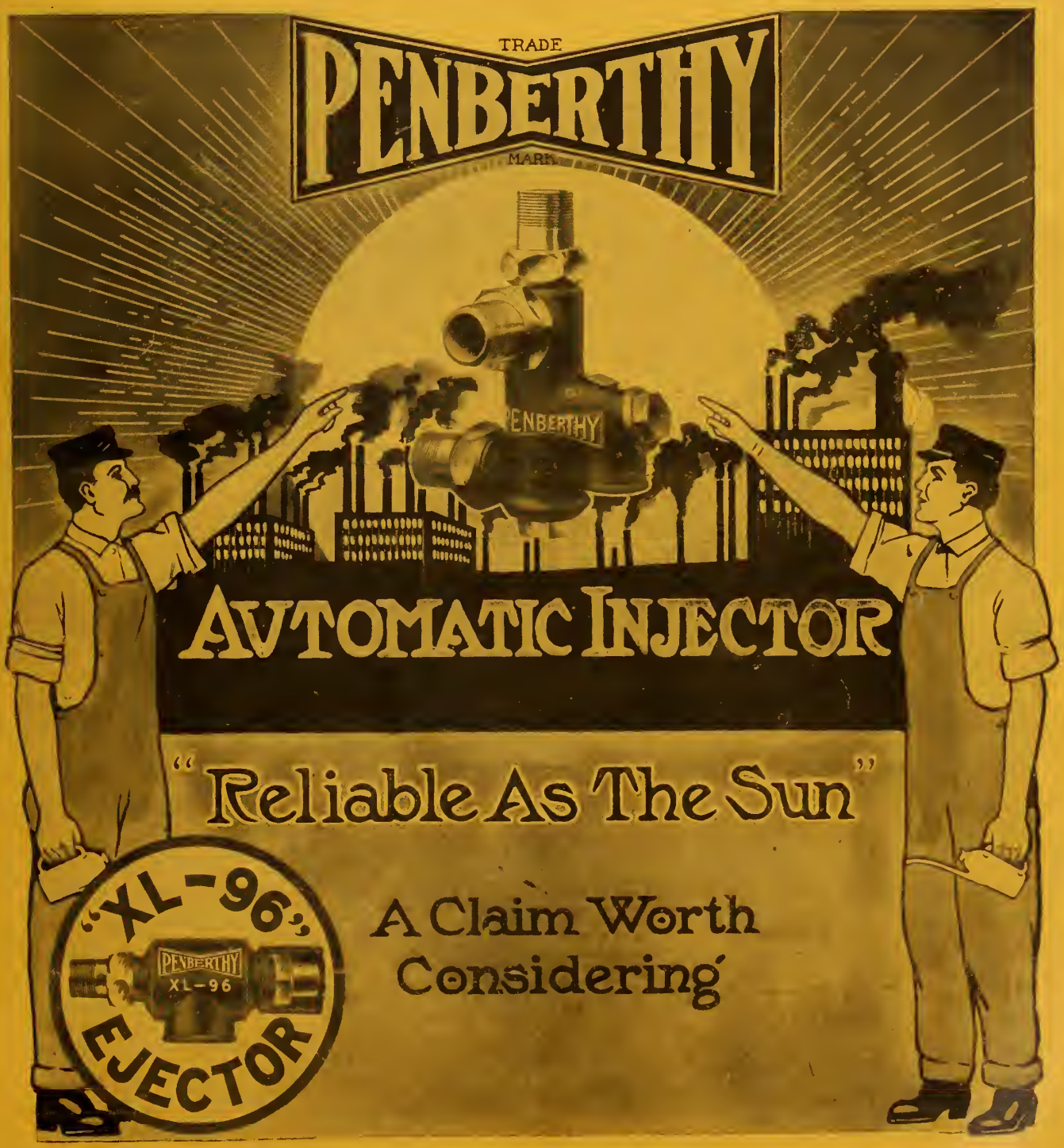
5,000 Copies of this issue are printed and circulated.
Report of C. A. S. E. Convention in this issue

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by the MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C

Vol. I. Publication Office, Toronto — September, 1908 No. 1




PENBERTHY INJECTOR COMPANY, LIMITED, WINDSOR, ONT.

# The Gas and Electric Power Co.

SOLE AGENTS FOR

## Ferranti, Limited

World-Renowned Integrating Watt Meters.

Recognized to be the best instruments in the world.

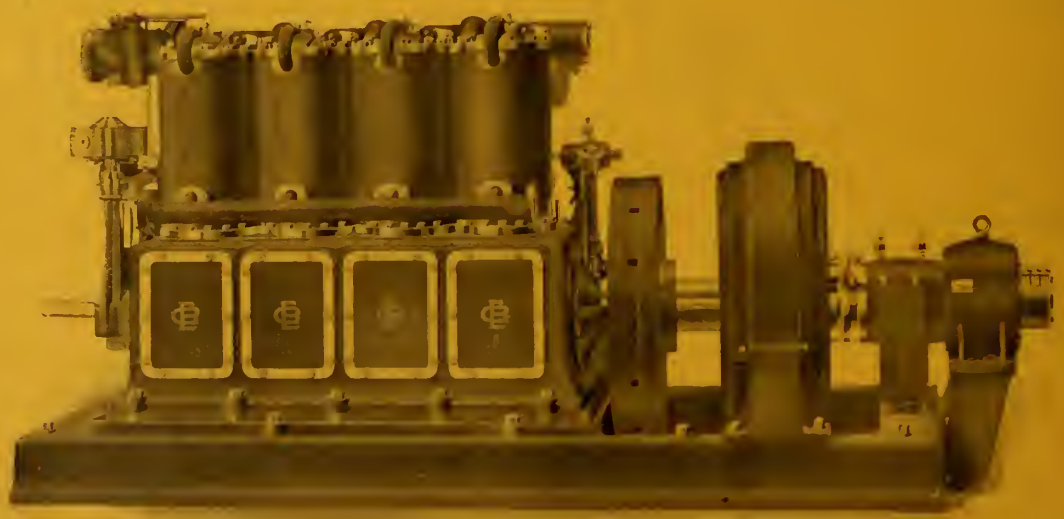
Manufacturers of H. T. Switch-Boards and other high-grade apparatus.

ALT. CURRENT WATT METER
Complete

ALT. CURRENT WATT METER
Without Case

Engines Guaranteed for Synchronising Alternators. Most Economical Plant Known.

HIGH QUALITY HIGH EFFICIENCY



FOUR-CYLINDER HIGH-SPEED GAS ENGINE, DIRECT CONNECTED TO ALTERNATOR

Engines built for all purposes for use with Producer, Natural or Town Gas.

Prices and particulars from

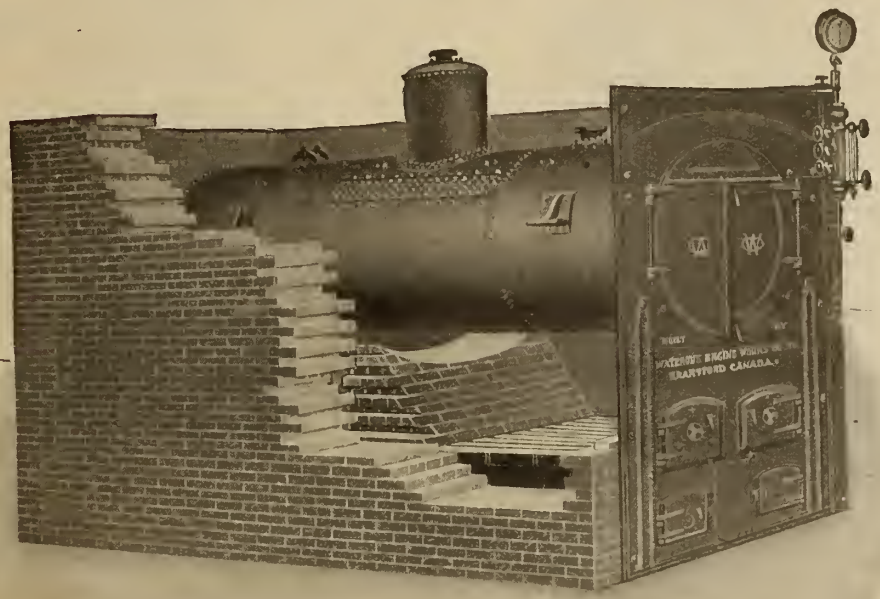
## The Gas and Electric Power Co.

Stair Building, Bay Street

## Toronto

Complete Gas and Electrical Plants Equipped.

# STEAM PLANTS

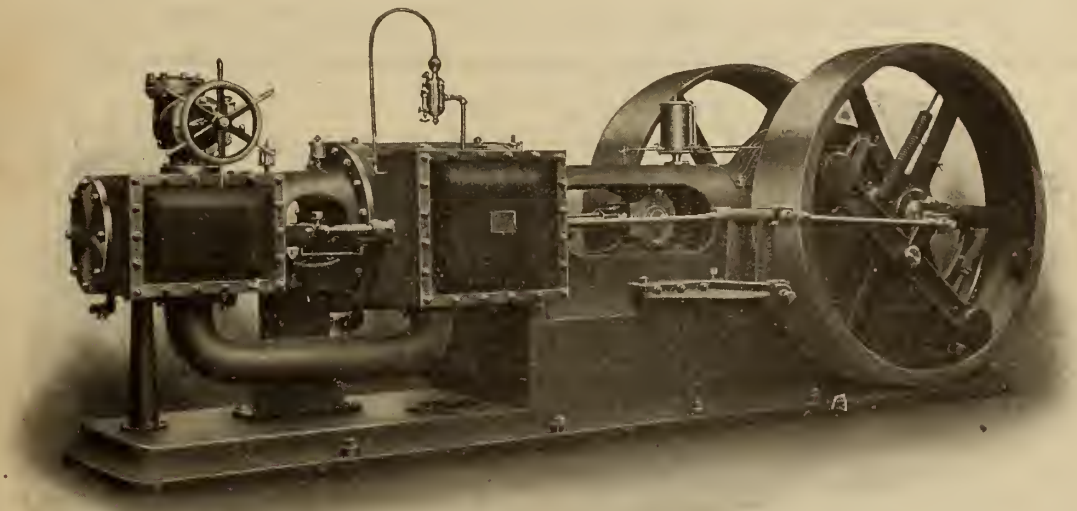


## Standard Tubular Stationary Boilers

The cut represents this style of boiler with ordinary full front setting. Half front and different styles of oven settings can be furnished if desired.

These boilers are built for various pressures and from 10 to 200 horsepower.

For further details and particulars ask for our special Boiler Catalogue, which will be gladly furnished on application.



*350 H.P. Tandem Compound Automatic McEwen.*

We manufacture : Boilers, all types ; Stationary, Marine, Automatic, Simple and Compound Engines ; Steam Plant Accessories.

**Write for Bulletin and Prices**

## The Waterous Engine Works Co., Limited

**BRANTFORD - ONTARIO**

***Western Branch : Winnipeg, Man.*** ***B.C. Agent : H. B. Gilmour, Vancouver***

# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**KILMER & PULLEN,** 505 McKinnon Building, TORONTO

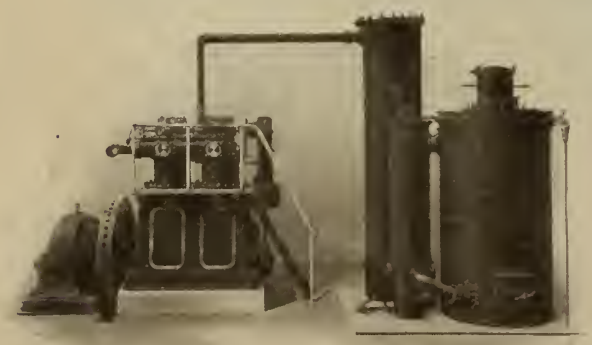
THE

# Warren Gas Power Plant

IS

# Pre-eminently Reliable

Daily and hourly proof of this fact is being demonstrated by the 5,000 h.p. of Warren Engines which are giving absolute satisfaction to their owners within one day's travel of Toronto. Our unique selling policy amounts to a positive guarantee of reliability.

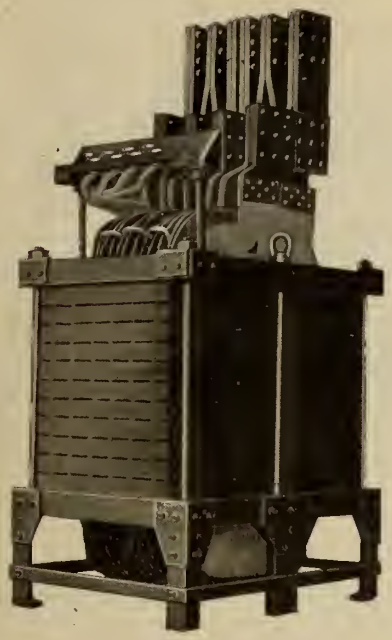


The cut shows the Warren Vertical Automatic Gas Engine and Suction Gas Producer manufactured by Struthers-Wells Company, Warren, Pa. Among its many exclusive points are these: Few working parts—what few there are being in plain sight and easy to get at. Large and easily accessible water areas for cooling cylinders. Force feed oilers provide positive lubrication. **Power users are invited to send for illustrated circulars.**

## W. H. OLIVER & CO.

EXCLUSIVE CANADIAN SALES AGENTS

M. 509, McKinnon Building, Toronto



750 K.W., 25 Cycle
1,200 Volt Transformer

**Packard Transformers are recognized as the standard of reliability for all classes of Power service.**

# The Packard Electric Co., Limited

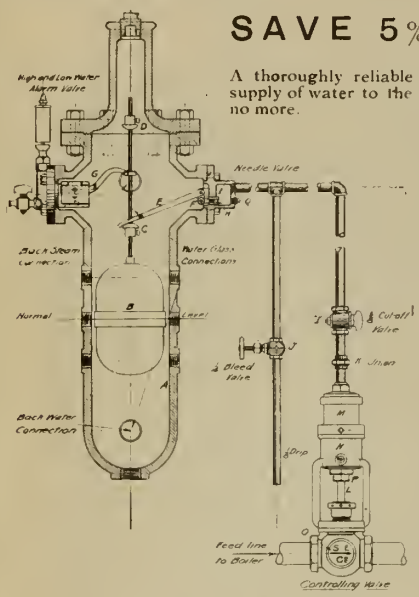
Head Office and Works, - St. Catharines, Ont.
Western Office, - Somerset Bldg., Winnipeg
Eastern Office, - - Bell Telephone Bldg., Montreal

**Type D. Induction Motors are built for severe service, strong and rugged in construction, great overload capacity, high efficiency and low temperature rise.**

20 H.P. Induction Motor. Type D.

# STANDARD AUTOMATIC BOILER FEED REGULATORS

## SAVE 5% IN FUEL




A thoroughly reliable machine that regulates the supply of water to the boiler just as required, and no more.

Maintains a constant level of water in the boiler, within one half inch from where wanted. Gives you the maximum space for steam.

Saves expansion and contraction due to hand feeding.

Made of the best materials and built interchangeably on the Universal system.

All valves can be removed for inspection while boiler is in operation.

Absolutely prevents explosions due to low water.

Few and simple parts, therefore reliable in operation.

Drawing No. C-105 sent free to Engineers.

***A Necessity on Every Boiler.***

SEND FOR DESCRIPTIVE PAMPHLET—FREE ON REQUEST.

**The Standard Engineering Co.**

STEAM SPECIALTIES DEPARTMENT

43 Scott St. - TORONTO, CAN.



NEW MODEL "M"

# Richardson Sight Feed Oil Pump

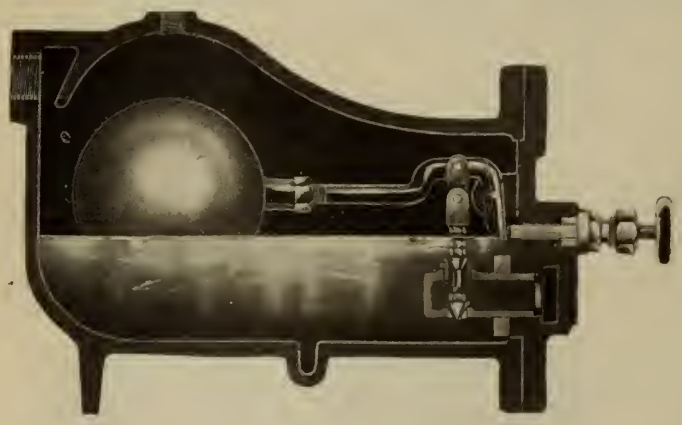
To those interested in the details of construction, a story about the kind of material used and the valuable improvements incorporated will be found in bulletin No. 109. May we send you one?

MANUFACTURED BY

**Sight Feed Oil Pump Co.**

MILWAUKEE, WIS., U.S.A.





## The Modern Steam Trap

# Sheldon Continuous Flow Float Trap

**Adapted for High or Low Pressure Work**

Greater capacity than single valve traps.
Discharges continuously as fast as the water enters.
Double cone-shaped balanced valves operated by a high pressure seamless copper float, tested to 300 pounds pressure.
The conical shape of the valves makes it impossible for them to stick or be affected in any way by foreign matter which may enter the trap.
All working parts attached to the trap cover, which can be removed without disturbing the inlet or outlet pipe connections.
By-pass valve in cover so steam can be given a free passage around the valves when desired.
Casing provided with bosses which are tapped for gauge glass and air cock.

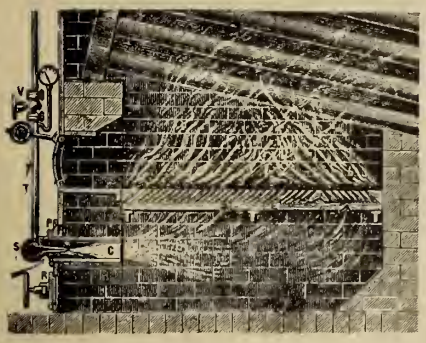
Write for Sectional Catalogue No. 56.

Eastern Agents:
**ROSS & GREIG**
225 St. James Street
Montreal, P.Q.

# SHELDONS LIMITED

GALT, ONTARIO, CANADA

Stocked in all sizes for immediate shipment.



# Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

Saves 20% to 50% in your fuel bills.

*For Particulars Apply*

**J. de Clercy, C.E.**

**62 Ontario St., West**

**MONTREAL**

**OPAL GLASS TILING**

FOR WALLS OF

**MACHINERY AND POWER HOUSES**

Most approved material.

**TORONTO PLATE GLASS IMPORTING CO'Y**

PLATE AND WINDOW GLASS

135 to 143 Victoria St., - Toronto


## Tenders for Transformer Station Equipment.

Tenders will be received until 6 p.m. Monday, 28th September, 1908, (a) For the supply and erection of 63,500 Volts Single Phase or 110,000 Volt Three Phase Transformers for operation on the Commission's 110,000 Volt Transmission System; (b) For the manufacture, supply and erection complete of the Switching and Indicating Apparatus for the 110,000 Volt Transformer Stations. Apparatus is required for the following high tension transformer stations: Niagara Falls Step-up Transformer Station, Toronto, London, Dundas, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock, Brantford and St. Thomas Step-down Transformer Stations; all according to plans and specifications to be obtained at the Commission's Office, Continental Life Building, Toronto. Accepted cheques on chartered banks for amounts specified in "Instructions to Bidders" must accompany each Tender for the work. These cheques will be forfeited providing the Tenderer declines to enter into a Contract after due notice by the Commission.

The lowest or any Tender not necessarily accepted.

Tenders must be sealed and addressed:

HON. ADAM BECK,

Chairman Hydro-Electric Power Commission of Ontario.

Toronto, Ont.

Newspapers inserting this advertisement without authority from the Commission, will not be paid for it.

Persons addressing advertisers will kindly mention this paper.


**FOR YOUR SWITCHBOARD**

Cast Copper Terminal Lugs

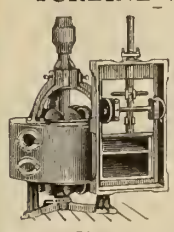
We Manufacture Switches and Switchboards

Address: Power Department

HILL ELECTRIC MFG. CO.,

1560 St. Lawrence Boul Montreal

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest efficiency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

Write for descriptive catalog.

**J. C. Wilson & Co.**

**GLENORA, ONT.**

Builders of Power Transmission Machinery

Machine-cut Wood and Iron Tooth Gearing our specialty.

**When a Leather Belt is not satisfactory, it is a costly nuisance. You cannot afford to make mistakes. You run no risks when you buy**

**"CLIMAX"**

**BRAND**

**It is the acme of perfection in belt making, and our years of experience and high-class workmanship—in fact our whole reputation—are behind it.**

***LET US KNOW YOUR WANTS***

**SADLER & HAWORTH**

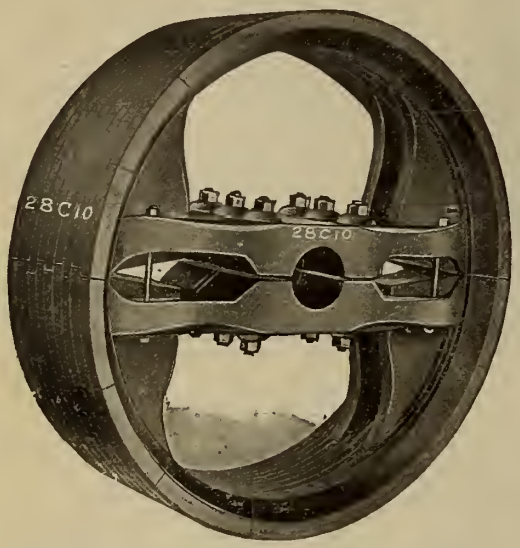
BRANCHES AT ST. JOHN N.B. WINNIPEG CALGARY VANCOUVER.

TANNERS & MANUFACTURERS OF

**OAK LEATHER BELTING**

FACTORIES MONTREAL-TORONTO.

# TRANSMISSION APPLIANCES




## FAIRBANKS WOOD SPLIT PULLEYS

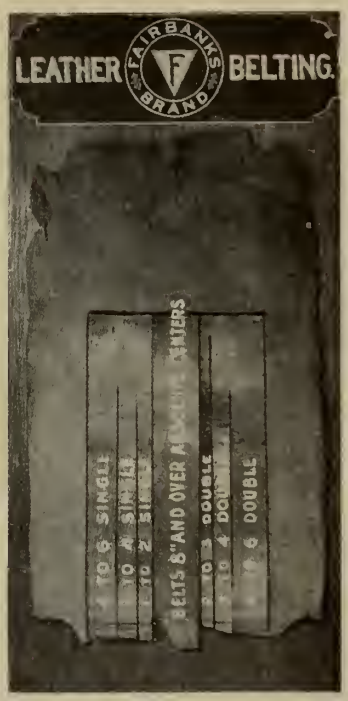
are made from well-seasoned lumber, carefully selected and dried. Each segment, besides being glued, is nailed to the next one. The Web construction of the arm strengthens the rim and prevents it from working loose at the arm.

## Fairbanks Universal Hangers

are practically self-adjusting.

**RIM OILING BOXES**

Bearing can be put into frame or removed without taking off yoke.




## FAIRBANKS OAK BARK TANNED LEATHER BELTING

is taken from that section of the hide running four feet from the tail towards the shoulder and for fifteen inches on either side of the back bone.

This part of the hide can be absolutely depended upon to yield the highest grade of belting.

# The Canadian Fairbanks Co., Ltd.

MONTREAL

TORONTO ST. JOHN, N.B. WINNIPEG CALGARY VANCOUVER

STEPHENSON
BAR BELT DRESSING
PRESERVES BELTS - PREVENTS SLIPPING

## THE AFTER EFFECTS ARE PLEASANT

Don't waste good belts and lose valuable power. **STEPHENSON Bar Belt Dressings** contain no Rosin nor any other ingredients injurious to Belting. Our **RED Label** and **Green Label Brands** are two entirely different and distinct preparations. No **one** kind of Dressing is good for **all** Belts — you know that. **STEPHENSON Dressing** not only prevents slipping and gives full speed from slack belts, but **the after effects are pleasant**—it KEEPS those belts in good condition and greatly prolongs their life.

This means a saving in BELTING, which is an important item when figuring the year's expense.

**RED Label Brand** for Leather belts;
**GREEN Label** for Rubber and Canvas.

Your protection against substitution is **The Man with the Cog-Wheel Face** on each Pound Stick.

Of Dealers everywhere, or

STEPHENSON MFG. CO.

ALBANY, N. Y.

# British Machinery

**High Grade, Efficient, Strong, Reliable**

**SPECIALTY**

**Kenyon's Cotton Driving Rope**
**Reynold's High Speed Chain**

## JONES & GLASSCO

MONTREAL

## MODERN EXAMINATIONS OF STEAM ENGINEERS

By W. H. WAKEMAN.

The fifty-three chapters of excellent reading in this book fully answer THREE HUNDRED practical questions about Engines, Boilers, Safety Valves, Belting, Shafting, Steam Heating, Boiler Bracing, etc. It is an excellent book of reference, especially written for Engineers and Firemen, and is UNIVERSALLY ACKNOWLEDGED as the BEST and MOST COMPLETE work on the subject.

THIRD EDITION NOW READY.

272 Pages. Fully Illustrated.

Price, $2.00, Postpaid.

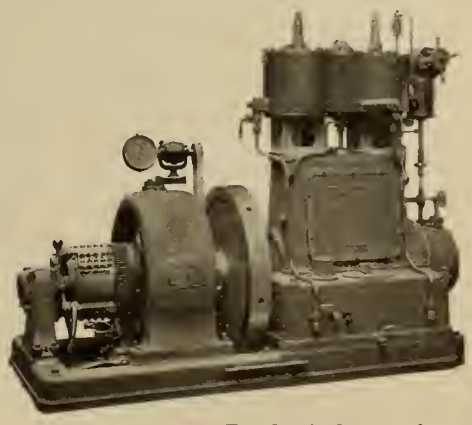
Maclean Publishing Company
Technical Book Dept.
10 Front St. East, - Toronto

Established over 50 years. Telegrams: "Belliss Birmingham." Code: "A.B.C. 5th edition"

## BELLISS & MORCOM LIMITED

***ENGINEERS***

***Birmingham, - - England***



Representing our Two-Crank Compound Type Engine.

## ENGINES

***DIRECT, ROPE OR BELT DRIVE for***

**Electric Power Lighting, Traction and Mill Driving**

***ALSO***

**CONDENSING PLANTS**

***6,500 H.P. installed in Canada***

**ADVANTAGES** — Self-Lubrication; Simplicity; Strength; Experience; Low Cost; Reliability; Minimum Maintenance; Compactness; Good Governing; Durability; Maintained Efficiency; Quiet Running.

**3 800** Engines supplied or building, representing upwards of **650,000 H.P**, in sizes ranging from **5 TO 2,700 B H.P**, of Compound and Triple-Expansion Types.

SOLE AGENTS FOR CANADA:

***LAURIE & LAMB, 211 Board of Trade Buildings***

***MONTREAL, CANADA***

Telegraphic Address. "Larco" Montreal. Codes: A.B.C. 5th Edition and Western Union.

# HEAVY DUTY GOLDIE CORLISS STEAM ENGINES

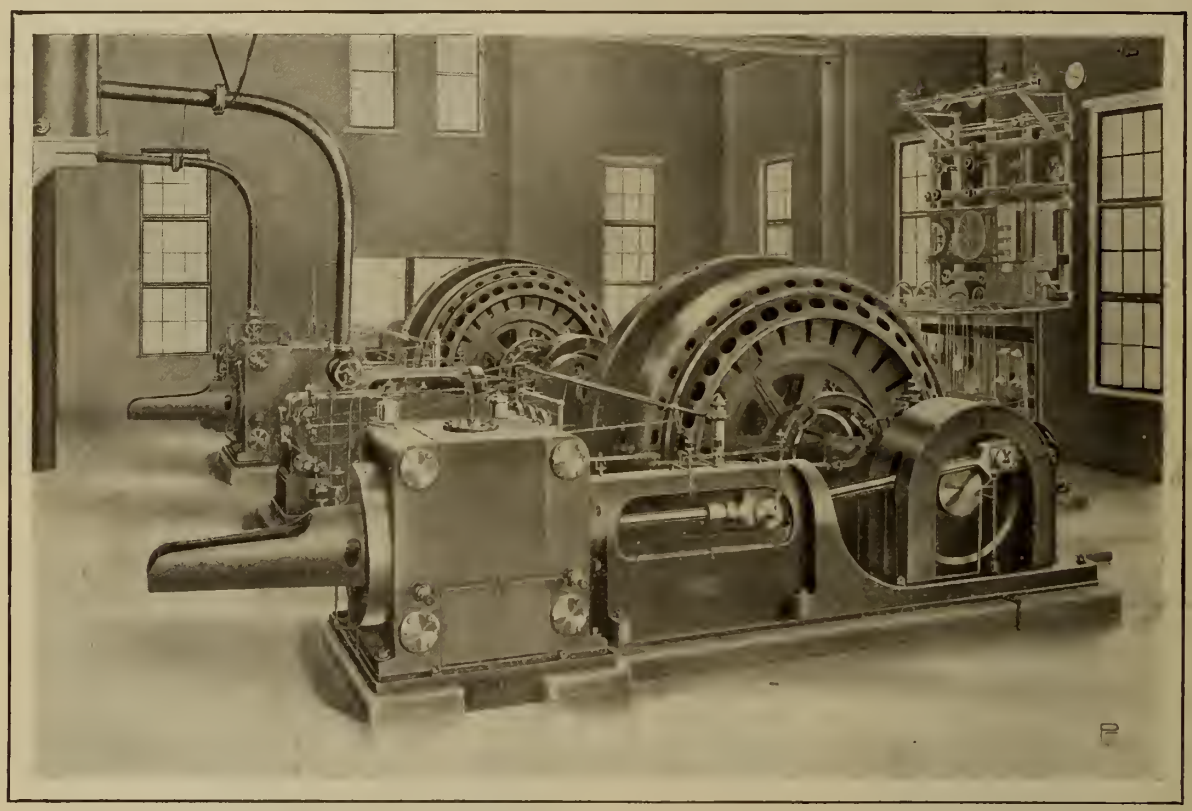


Illustration shows the Power House of the WINDSOR, ESSEX and LAKE SHORE RAPID TRANSIT RAILWAY, equipped with two pair of Cross Compound GOLDIE CORLISS HEAVY DUTY STEAM ENGINES. Each 20 and 40 x 36, Direct Connected.

## The Goldie & McCulloch Co., Limited

### GALT, ONTARIO, CANADA

WESTERN BRANCH,
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS,
Ross & Greig, Montreal, Que.

B. C. SELLING AGENTS,
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Boilers, Special Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION

# Convention of Canadian Association of Stationary Engineers

## Full Report of the Nineteenth Annual Convention at Windsor—New Officers—London Next Place of Meeting—What was Exhibited.

The nineteenth annual convention of the Canadian Association of Stationary Engineers was held in Windsor from August 11th till August 13th. The City Hall was used as the convention headquarters. The convention opened Tuesday noon, when Mayor Wigle extended a cordial welcome to the visiting delegates. At one time the Mayor of Detroit, W. C. Maybury, held the championship for extending official welcomes, but the honor has now been transferred to Ernest S. Wigle, Windsor's chief executive, and who is the recognized past Grand Master of the Noble Order of Glad Hand and Beaming Countenance.

Alderman Foster, who, like his namesake, is quite an orator, couched his words of welcome in brilliant and fitting style.

The addresses of welcome were responded to by treasurer A. M. Wickens, and the president, Ed. Grandbois.

### Tuesday's Session.

At the termination of the reception ceremonies the association went into regular session, and the business of the convention began.

Moved by Bro. Wickens, and seconded by Bro. Kelley, that the names be listed of those present and inserted in "Who's Who." Carried.

W. A. Crockett, executive secretary, read the minutes of the last grand meeting, which were duly approved and adopted, on the motion of W. Norris and W. A. Sweet.

Bro. Moseley remarked that a report of the proceedings for the year 1907 was the most complete of any he had ever seen, and he would like to see the good work continued.

The Striking Committee consisted of W. Norris, John Bain, A. W. Borbridge, J. Ironside and J. Agle. Moved by Bro Dawson and seconded by Bro. Fowler that Bro. Phelps delegate from Petrolia, be admitted. Carried. Bro. Phelps was then introduced to the convention, and was heartily received.

Delegates at the Convention of C.A.S.E., at Windsor, Aug. 11, 12 and 13. Supplymen at the Back.

### The Secretary's Report.

The secretary reported as follows:

"I have again the honor and privilege of submitting a report of the proceedings of the Executive Council of the C.A.S.E. for another year, this being the nineteenth year of our existence. Two new lodges have been added to our ranks, Midland and Ottawa, and in this connection I desire to mention the names

of J. Baldwin, Midland, Bro. Donaldson, Toronto, and F. J. Merrell, Ottawa.

I desire to thank the officers of subordinate lodges for their courtesy and promptness. I also thank Berlin for their reception this spring. I visited during the year Berlin, Windsor, Chatham, London and Toronto. Had time permitted I should have been delighted to visit more.

I trust that nothing has arisen to mar the harmony and good feeling that exists among our members.

There have been many enquiries concerning our association, especially from the Northwest Territories.

Our finances are in good shape, and we are steadily forging ahead.

Receipts to July 31st, 1908:

August, '07:

| | |
|---|---|
| Cash on hand | $373 24 |
| Dues, etc. | 300 28 |
| Interest to date | 2 77 |
| | $675 59 |

Disbursements:

| | |
|---|---|
| Expenses of the Guelph convention | $213 40 |
| Secretary's honorarium | 25 00 |
| Ed. Grandbois' expenses | 7 30 |
| Committee meeting, Oct., '07. Toronto | 14 50 |
| Guelph souvenir | 17 50 |
| Stationery, etc. | 46 85 |
| Printing | 7 50 |
| Advertising | 22 50 |
| Lapel buttons | 36 75 |
| Postage, express charges, etc. | 19 56 |
| Total | $409 86 |
| Receipts | 675 59 |
| Expenditure | 409 86 |
| Cash on hand | $265 73 |

Membership is as follows:

| | |
|---|---|
| Toronto, Lodge No. 1 | 104 |
| Hamilton, Lodge No. 2 | 60 |
| Brantford, Lodge No. 4 | 7 |
| Ottawa, Lodge No. 7a | 36 |
| Guelph, Lodge No. 7 | 31 |
| Berlin, Lodge No. 9 | 14 |
| Waterloo, Lodge No. 17 | 9 |
| Chatham, Lodge No. 21 | 21 |
| Owen Sound, Lodge No. 25 | 21 |
| Galt, Lodge No. 27 | 24 |
| Kingston, Lodge No. 27a | 27 |
| Windsor, Lodge No. 28 | 22 |
| Petrolia, Lodge No. 29 | 21 |
| London, Lodge No. 30 | 51 |
| Stratford Lodge No. 31 | 29 |
| St. Thomas, Lodge No. 32 | 35 |
| Midland, Lodge No. 33 | 18 |
| Total | 520 |

The names and addresses of the secretaries are as follows: W. B. Archer, 213 Pape Ave., Toronto; C. A. Leckie, 58 Ashley St., Hamilton; J. Ogle, 73 Richmond St., Brantford; F. J. Merrell, 38 Fourth Ave., Hintonburg; J. J. Heeg, Box 825, Guelph; C. Emmeritz, 186 Victoria St., Berlin; Chas. W. Dobbin, Waterloo; J. Congdon, Box 113, Chatham; Wm. Johnston, National Table Co., Owen Sound; E. W. Geiger, Preston; P. J. Milne, 164 Bagot St., Kingston; J. J. Jacob, 99 Crawford Ave., Windsor; E. Preston, Petrolia; W. Norris, 47 Byram Ave., London; A. Scrimgeour, 362 Brunswick St., Stratford; S D. Spire, Box 523, St. Thomas; John A Baldwin, Clinton.

I strongly recommend the Committee on Good of the Order to consider the advisability of extending work along the line of last year's report. The License Law has been amended, and will come into force on January 1st, 1908. The Government of Ontario have promised to appoint examiners in the near future to act under the new law. A circular letter was issued to all the subordinate lodges.

(Signed) W. A. CROCKETT.

### A Copy of Circular Letter.

Dear Sir and Brother,—At no time in our history have we needed more help and assistance than at present. Our future depends to a great extent on what we do now. The world seems to say, "Do something, and do it now." That something we should all assist in doing. To the secretaries of subordinate lodges I desire to point out the fact that your individual council is needed We have the framework of the finest technical association for engineers in existence and it remains for every individual engineer to help us to pursue a persistent, wise and steady course and thus be assured of final success and prosperity.

Again and again it has been pointed out that the C.A.S.E. is formed for the purpose of mutual instruction and advancement in the profession, and for social intercourse.

We are steadily advancing, and so we should, because our principles are so founded as to insure success; and so to this end we again bring to your notice our preamble.

We have associations in Toronto, Hamilton, Brantford, Galt, Guelph, Berlin, Ottawa, Waterloo, Chatham, Owen Sound, Kingston, Windsor, Petrolia, London, Stratford St. Thomas and Midland. Every city, town and village where seven or more engineers are employed should organize and join us. We are not a labor organization. We invite to our open meetings every engineer who is not a member, and we would like the manufacturers to accept the invitations to attend our meetings and take part in the discussions with us. We want every engineer to join us, not so much for pecuniary help, although that is needed in equipping our lodges with indicators, models, etc., as for individual co-operation in advancing our profession.

It is the organized effort that counts and counts big. The engineer who can help us best is the one who attends his meetings regularly. He becomes a trained and accurate worker and assists others to be the same. Your example is followed by others; your attendance encourages others, thus adding strength to your own. Working on these lines will eventually expand and strengthen your arena of influence, extending your mental horizon. Again you will need us and we will need you.

If while being organized we work together in harmony we can triumph over a vast number pulling in different directions.

If you believe in co-operation, co-operate with us. Knowledge is power but remember we cannot know it all, as it takes everybody to know everything and very little of anything is yet known. Our association is made up of subordinate lodges, and these lodges of individuals. As the members are true to the lodge, the lodge is influential in the association.

Toronto, Lodge No. 1, recommends as follows:

Executive Council Constitution.

Amend article XII, section 1, to read as follows: The annual convention be held by-annually.

Subordinate Constitution:

Amend article XI, section 2, by inserting after the word "fees," the words, "Not to exceed the sum of $1." That article XIII, section 1, be rescinded.

It is probable that a resolution will be brought forward to the effect that no delegate will be permitted to act on the Executive Council unless actually operating or in charge of a plant.

(Signed) W. A. CROCKETT.

Moved by Bro. Moseley, and seconded by Bro. Dawson, That the secretary's report be received and handed to the Committee on Good of the Order, and that the secretary be one of that committee Carried.

### Treasurer's Report.

The treasurer, A. M. Wickens, stated that the year's finances were in good shape, and that although books were only posted up to July 31st, that $208 had been received since August 1st, making a cash balance of $473.73. Moved by Bro. Moseley and seconded by Bro Archer, that the treasurer's report be received. Carried.

The meeting adjourned at 3.10 p.m. to meet again at 7 p.m.

The rest of the afternoon was taken up with a ride to Walkerville, where the delegates were shown around Walker's

Distillery, each being presented with a sample of the product. From Walkerville they went to Sandwich, and from thence to Peabody's overall factory.

New Officers of the C.A.S.E.

Back Row, reading from left to right:—W. McGhie, Toronto, Vice-President; W. Norris, London Doorkeeper; Jos. Ironsides, Hamilton, Past President; W. A. Crochet, Mt. Hamilton, Secretary. Front Row:—J. J. Nagg, Guelph, Conductor; Chas. Kelley, Chatham, President.

**Evening Session, Tuesday.**

The evening sessions on Tuesday night, opened at 7 p.m.

Moved by Bro. Kelley and seconded by Bro. Archer, That in future all amendments to the Constitution and By-laws shall be sent to the Executive Secretary on or before the first day of June preceding the convention. Amendments to be printed or typewritten and a copy of the same to be mailed to each of the subordinate associations, not later than July 1st of each year; and that any amendment received after the date above mentioned shall not be entertained. This was finally carried after much discussion.

Moved by Bro. Archer and seconded by Bro. Bain, That the Constitution, article XII, section 1, be amended to read: "The annual convention shall be held on the last Tuesday in July each year and shall last for three days unless it be found necessary to lengthen or shorten the session by one day, which can only be done by motion." This was freely discussed by Bros. Revell Moseley, Kelley, Wickens, Tait, Bain, Norris, Dawson, Borbridge and Heath, and was finally carried.

A motion by Bro. Moseley, seconded by Bro. Tait, That the convention be held by-annually was lost.

Moved by Bro. Archer and seconded by Bro. Nolan, That article XI, section 2, of the Constitution, be amended to read after the words on payment of not more than $1 shall be, etc. Carried. Moved by Bro. Archer, seconded by Bro Taylor, That article XIII, section 1, be rescinded. Carried.

Sessions adjourned at 9 p.m. till 9 a.m. Wednesday morning.

**Banquet is a Great Success.**

At the British American Hotel on Tuesday night a complimentary banquet was tendered the visiting delegates, at which the ladies were present. The banquet was all that could be desired and at its termination Chas. Kelley started his duties as toast master.

All the visiting delegates, including those from the National Association of Stationary Engineers, joined heartily in the singing of the National Anthem. A toast to Canada was proposed by Jack Armour, who made hit after hit with his comical stories and witty remarks. This toast was responded to by A. M Wickens, W. A. Crockett and J. T Wing. Mr. Wickens referred briefly to a great number of things for which Canada was famous. W. A. Crockett delivered one of his rousing addresses J. T. Wing spoke of the friendly feeling which existed between the members of the Canadian Association and the American Association. A toast to Our Legislative Assembly was ably responded to by Hon. R. F. Sutherland, Speaker of the House of Commons. Mr. Sutherland

The Supplymen at the Convention of C. A.S.E.

Back Row, reading from right to left:—E. F. Heatherington, Goldie & McCulloch, Galt; Waters- "Canadian Manufacturer"; P. J. Sweeney, Penberthy Injector Co.; J. C. Armer, "Canadian Machinery" and "The Power House"; Cole, Philip Carey Mfg. Co.; McIntyre, "Power and the Engineer. Second Row:—F. G. Robinson, Canadian Fairbanks Co.; W. R. Stavert, Jenkins Bros., North, Penberthy Injector Co. First Row:—Jack Armour, "Power and the Engineer"; E. A. Wilkinson, Lunkenheimer Co.; Arch. Smith, "The Engineering Journal of Canada."

spoke of the great work which was to be done in technical education. He advised the association to interest the Government by getting their local members interested in their association, informing them exactly what they would wish the Government to do for them. He thought that the association was working along correct lines, and that this fact should be appreciated. He spoke of himself as a Stationary Engineer, "Because," said he, "I am stationary in my chair in the Legislature, and take some good engineering occasionally to keep things straight in the house. Therefore, I am a stationary engineer."

The toast to the Mayor and Corporation was responded to by Mayor Wigle Alderman Foster and Alderman Stuart

A toast to Our Executive Officers was responded to by Bros. Moseley, Sweet and Norris, who outlined the aims and objects of the association.

A toast to Our Subordinate and Sister Societies was responded to by N. G. Stone past president of the National Association of Stationary Engineers who spoke at length on the good to be derived from the connection with societies of this kind, and thought that too much stress could not be placed upon the future of such organizations. The toast was also responded to by Bro. Dawson and Bro. Borbridge.

### Wednesday Morning Session.

At 9.30 a.m. on Wednesday morning the roll call showed that all members were present.

Delegate Taylor wished information regarding badges for subordinate lodges Secretary Crockett informed him that an official button was issued and that officers of subordinate lodges always wore these emblems while attending meetings.

Bro. Fowler expressed the opinion that on account of the many bright and good ideas possessed by Bro. Norris he be placed on the Good of the Order Committee.

Moved by Bro. Dolan and seconded by Bro. Dawson, That we endorse the attitude taken by our secretary in some matters relating to the Northwest Territories. Carried.

Moved by Bro. Moseley and seconded by Bro. Phelps, That the secretary have full power to settle any little troubles and difficulties in regard to the business of the Executive. Carried.

Moved by Bro. Moseley and seconded by Bro. Kelley, That credential cards be supplies to all subordinate lodges with instructions that signatures of the president and secretary of these lodges be affixed thereto. Carried.

Moved by Bro. Wickens and seconded by Bro. Archer, That the ladies be permitted to form an auxiliary lodge to assist in convention work.

Bros. Fowler, Clark and Dawson spoke of the good work done by the ladies of Windsor in entertaining the visiting ladies.

Moved by Bro. E. J. Taylor and seconded by W. C. Tait, That the incoming Executive Secretary be instructed to make out and send to all subordinate associations, to be distributed to all members of the order, a statement of the proceedings and financial report of the annual convention.

This, upon the motion of Bros. Archer and Bradd, was referred to the Good of the Order Committee.

Moved by Bro. Wickens and seconded by Bro. Moseley, That the Good of the Order Committee be requested to take up the matter of writing the Government in regard to examiners and the issuing of certificates. Carried.

As a result of Bro. Bradd's request for information in regard to a souvenir it was moved by Bro. Dawson and seconded by Bro. Dolan, That the matter be referred to a special committee, to consist of Bros. Archer, Taylor and Williams. Carried.

The meeting then adjourned till 9.30 Thursday morning.

### The Automobile Ride Around Detroit.

In spite of the heavy rain on Wednesday afternoon the automobile ride around Detroit, which was tendered to the visiting delegates at Windsor by the members of the National Association of Stationary Engineers, Lodges No. 1 and 7, of Detroit, proved very enjoyable. The delegates crossed the ferry, and were met by a special committee, who distributed a handsome N.A.S.E. watch fob. Several large power plants were visited, including the waterworks. A ride around Belle Isle Park and a visit to the Aquarium, proved exceptionally interesting and enjoyable. After the ride the delegates were entertained to a luncheon. After luncheon speeches were made by Bros. Ellis, Werner and Navy of the National Association of Stationary Engineers, who all spoke of the good fellowship which existed between the associations. W. A. Crockett responded for the Canadian Association He said it was more than a pleasure to be present at an event of this kind, where citizens of the two greatest nations on earth met together in brotherly love. "And why should we not meet thus," said he. "Do we not have the same colors in our flags, the same tune in our National Anthem, the same language, the same customs, the same race, the same laws, because American laws are formulated from British laws and, in fact, are we not one in the same Anglo-Saxon race springing from the same parentage?". Bro. A. M. Wickens also responded along the same line.

### A Successful Moonlight Excursion.

On Thursday night J. T. Wing & Co. entertained the delegates to a moonlight excursion on the river. The rain came down in torrents and there was no moon, but Wing's winning ways were waterproof. Refreshments were served, and an orchestra furnished music for dancing and other entertainment.

### Thursday Morning Session.

At 9.30 Thursday morning the delegates assembled at the Convention Hall all being present.

The report of the Mileage Committee was received on the motion of Bro. Dawson and Bro. Borbridge.

The report of the Ways and Means Committee recommended the following changes: First, that article XII, section 1, of the Constitution, be amended to read: "This association may provide for honorary members, to be elected from citizens who have been or are engineers, desiring, etc., Second, that the hours of meeting at the convention be fixed, and that they be, first day, 11 to 12 a.m., and from 2 p.m. to 5 p.m. succeeding days, 9 to 12 a.m. and from 2 to 5 p.m.; Third, that article XI should specify what goes with a charter: Fourth that something should be done towards securing cheap rates on the railways at the time of the convention."

This report was received on the motion of Bro. Dawson and Bro. Moseley.

This committee consisted of H. R Clark, Hamilton; W. W. Bradt, Windsor; W. G. Dolan, Berlin; E. Phelps, Petrolia; and F. Revell, St. Thomas.

### Report of the Good of the Order Committee.

On the motion of Bro. Moseley and Bro. Dawson, that report was taken up clause by clause.

The first clause: We would recommend that the Executive be authorized to issue a membership card, said card only to be issued by the local secretary to members of good and regular standing. This clause was adopted on the motion of Bro. Moseley and Bro. Dawson.

The second clause: That the Executive Secretary be empowered to purchase a typewriting machine to be used at the executive work. This clause was carried on the motion of Bro. Sweet and Bro. McGee.

Third clause: That a system of general examination be adopted in each subordinate lodge, whereby all members may be examined on all classes of certificates, and that all assistance be given to help members qualify; and that the Executive Council draft out rules to

govern this. This was adopted on the motion of Bro. McGee and Bro. Moseley.

The fifth clause referred to the pass word, and on the motion of Bro. Moseley and Bro. Dolan it was referred back.

The sixth clause. We would sugges in regard to communicating with th Ontario Government that since the Executive Secretary has been in touch with the department, no good could come from further communication at the present time. This, on the motion of Bro. Moseley and Bro. Borbridge, was amended to read, "Resolved, that this convention in session assembled do hereby call the attention of the Minister of Agriculture, as follows: The fact that the License Law now enacted and to come into force on the 1st day of January, 1909, is at present working a great injustice to a large number of engineers, many of whom are out of work. These men in applying for situations are often asked by the employer whether they have a certificate or license. The engineers are forced to respond in the negative because of the fact that they cannot procure one until the Government makes the necessary appointments. This is not satisfactory either to the manufacturer or to the engineer. Consequently, we pray that the machinery relieve this undesirable condition at a very early date."

Moved by Bro. Archer and seconded by Bro. Dolan, That the report be adopted as amended. Carried.

The auditors reported having gone over the books of the secretary and treasurer, and having found them to be correct in every particular. This report was adopted, on the motion of Bro. Archer and Bro. Dolan.

A letter was read from a number of the visiting ladies expressing their thanks to the local committee and particularly to Mr. Geo. Bradt, for the entertainment which had been furnished them.

### Election of Officers.

The following officers were elected:

President—Charles Kelley, Chatham.

Vice-President—W. McGhie, Toronto.

Secretary—W. A. Crockett, Mount Hamilton.

Treasurer—A. M. Wickens, Toronto.

Conductor—J. J. Hay, Guelph.

Door-keeper—W. Norris, London.

On the motion of Bro. Clark and Bro. Robert it was decided that London be the next place of meeting.

The meeting adjourned at 11.50 a.m

### Thursday Afternoon Session.

Resolutions were passed authorizing the secretary to send a communication of thanks to the Mayor and Aldermen of Windsor for their kindness; and to all others who had entertained the engineers during the convention.

Moved by Bro. Dawson and seconded by Bro. Archer, That the secretary be donated with $25. Carried. The hall was then thrown open for the supply men, each of whom spoke briefly, each expressing himself as well pleased with the convention.

At this session one of the most interesting events of the convention took place. That is, the instalation of officers. Bro. Ironsides was in the chair, and Bro. Sweet acted as conductor. Short speeches were made by each of the incoming officers, the tone of which showed that the assoeiation has made wise selections. The retiring president was presented with a beautiful case of jewelry. The nineteenth convention closed with the singing of Auld Lang Syne.

After the close of this session the delegates were taken on a car ride to Kingsville, where supper was served. In the evening a band concert was given by the city council of Windsor in honor of the visiting engineers.

### Meeting of the Supply Association.

On Thursday there was a meeting of the Canadian Engineers' Exhibitors held the following offieers being elected:

Hon. President—Wm. Norris, London,

President—W. R. Stavert, Jenkins Bros.

First Viee-President—Mr. Cole, Philip Carey Mfg. Co.

Second Vice-President—E. A. Wilkinson, Lunkenheimer Co.

Treasurer—F. G. Robinson, Canadian Fairbanks Co.

Seeretary—H. C. Anstin, Dunlop Rubber and Tire Co.

Assistant Secretary—E. A. Heatherington, Goldie & McCulloch.

### The Exhibits and Exhibitors.

The Canadian Fairbanks Co. made an exhibit of engineers' and power-house supplies, including specially the Fairbanks removable disc globe valves, removable ring and Dart patent unions Represented by F. G. Robinson.

The Goldie & McCulloch Co., Limited, Galt, were represented by E. H. Heatherington, who distributed a complete line of engine and boiler catalogues, including the "Wheelock Engine Instructions," a most useful book for anyone who is operating a Wheelock engine. Their handsome souvenir pencil was much appreciated.

Jenkins Bros., Montreal, showed a full line of their valves. This is the first time that their "Made in Canada" valves have been exhibited. Represented by W. R. Stavert.

The Dunlop Tire & Rubber Co., Toronto, had an exhibit of rubber packing and rubber hose, and other similar supplies. In the last two years the company has gone quite extensively into this line. Represented by H. C. Anstin

The Philip Carey Mfg. Co., Toronto exhibited all kinds of coverings for high and low pressure steam, brine, hot and cold water. A speeial feature of the exhibit was their 85 per cent. magnesia covering for high pressure steam insulations and their air cell coverings.

The Lunkenheimer Co., Cincinnati O., had an exhibit of steam specialties, features of which were the regrinding globe valves and Duro blow-off valves. Their Canadian agent, E. A. Wilkinson represented them. A new general catalogue is ready for general distribution.

V. D. Anderson Co., Cleveland, O., showed their traps and floats. Represented by L. H. Rumage, 1213 Michigan St., Buffalo, N.Y.

J. T. Wing & Co., Detroit and Windsor, showed their high-speed graphite metal, their high-speed spiral packing; and an assortment of pipe wrenches, tongs, fittings, etc.

The Penberthy Injector Co., Windsor, exhibited a full line of goods of their manufacture in their show room at 57 Sandwich St. east, under the supervision of their mechanical superintendent, Mr. Peter J. Sweeney. The new Penberthy sight feed lubricator was shown there, its many new features and other advantages over other makes being pointed out by Mr. Sweeney. A special catalogue illustrating this new line will be forwarded to anyone sending his name and address. The company gave all members of the C.A.S.E. and visitors a souvenir in the shape of a handsome watch fob.

### Notes of the Convention.

The secretary is a great orator.

The ladies being at the dinner added very materially to its success.

The Philip Carey souvenirs raised the roof of the hotel dining-room.

Power was there in full force.

The weather man didn't smile on the automobile ride; but all enjoyed themselves in spite of his endeavors to drown us out.

J. T. Wing's moonlight excursion was a great success. The moon hung from the beams of the boat, and the rain was never noticed.

On the trolley ride to Kingsville we all joined the carrot brigade to the sorrow of a certain carrot patch.

## BOILER FEED WATER AND SCALE*

By A. M. Wickens.x

I may say that after having spent my whole lifetime in connection with engines, boilers and steam plants generally, as an erecting engineer, as an operating engineer, and latterly as an inspector, I have arrived at some conclusions that are very strongly impressed upon my mind regarding feed waters, scale and other troubles that are met with continually in all steam plants. In many of our factories, the boiler part of the outfit seems to be the part of the whole establishment that receives the least consideration or attention, by the owner or manager. A steam boiler is not a very handsome-looking piece of apparatus; it is generally associated in the owner's mind as a miserable, dirty affair, buried in brick, soot and ashes, and with the assistance of the architect of the building, it is relegated into some dark, out-of-the-way place in the basement, crowded and pinched for room. No adequate means is provided to keep it clean, either inside or outside. This, to my mind, is very strange, because as a matter of fact, the boiler in reality is the heart of the whole establishment and the source of all the mechanical motion required in the factory and should have every advantage that ingenuity and carefulness can afford. Where boilers have been thus treated, the subsequent treatment of them is usually of a very poor and meagre character, and the result is a short and wasteful life. We have many forms or kinds of waste going on all the time in connection with our boilers, some from faulty construction or defective setting, some from bad chimney draft or bad management of the fires or from bad fuel, others, and many of them, from the use of bad feed waters and a collection of mud, soot, ashes and scale. If we expect good results and economical work, we must see that the surfaces of the metal are perfectly clean, both outside and inside. If we allow the outer portions of those exposed to the fire to become covered with soot and ashes, we have applied one of the most efficient non-conductors of heat known to science. Again, if we allow the interior of the metal to become coated with scale, mud or sludge, we have added another first-class non-conductor. The same applies to oil being allowed to gather in the metal with the added difficulty that the oil will surely make the rivetted joints leak. The efficiency of a boiler is the amount of heat the metal will transmit from the fire and hot gases to the water, and a well set, well fired, clean boiler will utilize from 70 to 75 per cent. of all the heat given off by the burning coal, consequently it behooves us to do everything possible to keep up to that standard.

All waters carry more or less mineral, earthy and organic matter, some of them are charged so heavily that they cannot be used for boiler purposes. Taking the evaporation of 34 lbs. of water per hour to represent one horse-power, a 100 horse-power boiler would need for a day of 10 hours 34,000 lbs. of water, this would be 3,400 gallons and as each gallon of water carries a certain amount of mineral or other matter that will not evaporate, we soon, even with the best of feed waters, accumulate scale-making material in our boilers. A feed water carrying from 20 to 40 grains of solid matter per gallon, may be called a good water for use in boilers. In the boiler above, if we have 20 grains to the gallon, it will deposit 50 lbs. per week of sixty hours' run, using three for the specific gravity of the scale, it would cover 250 square feet of the surface to a thickness of .0144 inch or 1-16 inch thick per month; with waters carrying more solid matter the deposit would be proportionately greater. From this you can readily conceive how quickly scale would form over the whole surface of the boiler below the water line. There have been many experiments and tests conducted to determine the loss in heat caused by scale of different thickness and different compositions. It is now generally accepted that hard scale 1-16 inch thick requires from 10 to 13 per cent. more fuel, and that as the scale thickens the extra fuel required also increases until at a thickness of ⅜-inch it is 40 per cent. In our river, well and lake waters, we have principally, as scale-forming matter, carbonate of lime, sulphate of lime, carbonate of magnesia, and some silica with traces of other solids, to deal with. The carbonate of lime, chemically speaking, is chalk, selenite, marble and limestone, and is held in solution in the water; by an excess of carbonic acid, this is driven off by heating the water and the carbonate is precipitated. A portion of all scale-forming matter floats upon the water in the boiler, while it is making steam, and only settles when the boiler is at rest. This is more particularly the case, when the water contains magnesia. The precipitated particles are carried with the water as it circulates in the boiler, and part of it will lodge in the stillest places, consequently, we have some parts showing thicker scale than others. We also find that the scale is always heavy near the discharge from the feed water pipe; this is because the incoming water soon receives heat enough to precipitate part of the solids, after it mixes with the hotter water in the boiler. Carbonate of lime and carbonate of magnesia deposit a fine powder and form a sludge with the water, but they also often solidify in combination with sulphate and form a very hard and tenacious scale. It is a decided advantage to all boilers to be fitted up with a surface blow-off, that all floating matter upon the water may be blown off frequently; this should be done, at least twice a day. A very hard thin scale, 1-64 inch or less in thickness of sulphate of lime, that is fast to the plates, will not be a detriment to the steaming of a boiler; the disadvantage of it is that it makes a good foundation for other scale-forming matter to build upon, and soon gets to be too thick. We frequently notice upon breaking a piece of scale that it is composed of different layers, all of different thicknesses and colors, and interspersed with thin layers of earthy matter. The face of this incrustation next to the plate is very often of a black color, and adhering to it is found a thin film of oxide of iron. The plate in all these cases bears unmistakable signs of wasting away; this is caused where the water carries iron salts, and in brackish water it is the chloride of magnesia which will attack the metal of the boiler very quickly. The circulation of the water in all boilers, while making steam, is continuous, and it is quite rapid from the hottest places, thus carrying scale-forming precipitates to cooler places and depositing them in the stillest spots; this helps the life of the boiler and assists in keeping the part that evaporates the most water the cleanest. All boilers generate twenty times more steam immediately over the grates than at any other point, thus making the ebulition so great and the circulation of the water so rapid, that most of the precipitates are carried away and are lodged in the portions of the boilers where the circulation is slow. We usually find scale between the tubes upon the boiler heads, upon the sides of the boiler opposite the tubes and upon the tubes. We very seldom find any upon the active portions of the shell, that is, immediately above the fire or grates; when it does appear there, we soon need the services of the boiler-maker for repairs. Sometimes we find a pile of loosened scale directly over the fire; this is caused by pieces that are too heavy to be carried away by the circulation, dropping down from the tubes; several of them lie close together, and the lighter pieces in floating by lodge with them, then some clay or silica stick to them, and we soon have a mass. This packs closer and closer until it is close enough to keep the water from the sheet, and the result is the sheet becomes red hot; the steam pressure then forces the sheet outward and makes a bulge or buckle. If this action goes on long

---

xChief Engineer of the Canadian Casuality & Boiler Insurance Co.

*A paper presented before the C A. S. E. at Windsor, August, 1908.

enough, the sheet stretches at the apex of the buckle, until the thickness is reduced to such an extent that the pressure ruptures the sheet, hence an explosion, such as occurred at the Toronto Bolt & Forging Works on September 14th, 1904.

Again we have scale forming in such quantities upon the tubes that the passages between them are entirely blocked; this retards the circulation to such an extent that the efficiency of the boiler drops from 50 to 60 per cent., and means that no amount of fuel will get the power out of the boiler, and it also means ruined boiler heads, and flue ends, and an astonishing bill for repairs. The effects of heavy scale are first of all an increase of fuel required, next the shortening very materially the life of the boiler with attendant repairs, accompanied all the time by a liability to a bad rupture or serious explosion. There are a large number of boiler compounds or purgers, some of them landed as a cure for all kinds of sediment and scale, and they are composed of nearly all kinds of foolish mixtures, some of which are very injurious to the metal; in fact, some of them will attack the metal and leave the scale entirely alone. The principle or base of many so-called compounds is common soda and soda ash. Tri-sodium phosphate, caustic soda and concentrated lye, chloride of barium catechu, nut galls, tannic acid and sal ammoniac, and even hydrochloric or muriatic acid, and to assist these some kind of slimy substance is added to prevent the scale from adhering to the metal. These are Irish moss, potatoes, oil, linseed, sugar, molasses and other similar ingredients; some of these mixtures are surprising, and it is a wonder they do not clean out the boiler, engineer, scale and all else about the factory. Some people will spend several hundreds of dollars per year for compound, and say: Well, we are doing all we can to keep our boilers clean, whether the compound is really just what is needed or not; others will not use anything, but spend money every three or four years to clean the boiler by removing the tubes, scaling off the shell, cleaning tubes, and replacing them. No matter which method is adopted, it is expensive, but if studied out carefully the fixed cost should not be great. An ordinary return tubular boiler well taken care of and using good water will last for thirty years and be safe the whole time, while if the water be bad, and the care worse, ten or twelve years is all the life we can expect to get out of them. Whether we will or no, all our waters have more or less scale in them, and we have, therefore, to do something to counteract it. All scales can be modified by some treatment, either in the boiler or while on the way to the boiler, or in the tank or well, before being pumped to the boiler. The first, by some suitable solvent; the second, by treatment in heaters in which enough heat is applied to precipitate the scale-making properties, and the last by chemical treatment before the water enters. Modern practice in large plants is adopting the last very generally, and water-softening plants for steam boilers are becoming common. These cost from $3 to $5 per horsepower for the apparatus, and from 1 to 2½ cents per 1,000 gallons for chemicals, and are proving to be a paying investment in many large plants. We meet another very serious trouble in many of our boilers in the shape of oil. This occurs more particularly in plants where exhaust steam from engines and pumps is utilized for heating buildings or other purposes, and the water of condensation returned to the boiler. There is nothing that will ruin a boiler or reduce its efficiency so quickly as a thin film of oil combined with some of the solid matter in the water. As a result of recent experiments, Sir A. Durston says, although too often neglected, grease and greasy water have a very dangerous influence on boiler plates, because grease being a bad conductor greatly checks the transmission of the heat. With a layer of grease, however thin, upon the boiler plates, although the temperature of the furnace may be no higher than before, the heat cannot pass out of the plates at the same rate at which it is received, and over-heating ensues. He conducted experiments with tubes and found that by a thin coating of grease, the decrease in the efficiency reached 11 per cent. He also found that in an experimental boiler the temperatures next the water were, with a clean plate 430 degrees, and with a greased one 617 degrees, or 187 degrees higher, thus showing the great loss upon the greasy plate. In practice we meet grease or cylinder oil in boilers, and always find it accompanied by leaky joints and tube ends, also by buckles and waves upon the bottom of the boilers if it settles. Oil can always be prevented in boilers by suitable separators and filters, consequently we should not be troubled by this difficulty. In conclusion, I may say that if we use our boilers well and accord to them the same amount of carefulness and study we do to the rest of our factory, they would last longer and give us more economical service, and we would not have to lie awake o' nights wondering what that old boiler will do next.

---

The millenium would approach within hailing distance if more people carried out through the week the suggestions they receive on Sunday.

## CATALOGUES WORTH HAVING.

TALK ON BRICK—"A Little Talk on Brick for Boiler Setting," is the name of a small booklet, just issued by the Harbison-Walker Refractories Co., Pittsburg, Pa. The booklet contains, as well as general information on their brick for boiler setting, a page or two giving pointers on brick-laying in order to get the best results.

THE NERNST LAMP—A small, neat booklet published by the Nernst Lamp Co., Pittsburg, Pa., giving a talk on the reliability and advantages of the Nernst lamp as it is put on the market to-day for various purposes.

STURTEVANT ELECTRIC MOTORS—Bulletin No. 159 of the B. F. Sturtevant Co., Hyde Park, Mass., giving detail information and illustrations on type H Sturtevant electric motors.

FLINN STEAM TRAP—Two-page circular descriptive of the Flinn steam trap, made by Richard J. Flinn, West Roxbury, Mass. This is something very interesting.

OILING DEVICES — An attractive catalogue illustrating and describing oil hole coverings and grease cups, and contains much of interest and value. The Winkley Co., Detroit, Mich.

SOLDERLESS CABLE JOINTS—Catalogue of Dossert & Co., Inc., 242-244 W. 41st Street, New York, telling about the Dossert solderless electrical connections or cable joints for stranded or solid wire. It is illustrated and contains information worth while.

---

## PERSONAL MENTION.

Mr. G. H. Kenyon, representing Wm. Kenyon & Sons, Ltd., Dunkinfield, near Manchester, Eng., is visiting Canada looking into the trade conditions. This company is represented by Jones & Glassco, Montreal, and it is the intention to make the system of rope drive which has been so successful in England better known in Canada.

---

From its attitude on the tariff question it is evident that the Steel Trust still believes itself to be an infant industry. It ought to be quite a sizable business when it grows up.

---

## McGILL ENGINEERING BUILDING.

The new McDonald Engineering Building, McGill University, Montreal, erected on the site of the old one destroyed by fire, April 5th, 1907, is now ready for the students. Accommodation is provided for six hundred students in mechanical, electrical and civil engineering and architecture and transportation. The equipment for the electrical, mechanical and hydraulic laboratories is now being placed in position for the opening of the session on September 21.

# Concerning the Application of Electric Motors to Machinery

## Simple Facts, Clearly Stated, Concerning Electric Motors; the Properties Which Make Each Suitable for Different Machine Drives.

By J. W. HELPS

The two chief reasons usually urged for the adoption of electric power in preference to any other are: adaptibility and economy. The former never has been questioned, but in very many cases economy is not achieved. Sometimes this defect is noticed, but more often it goes quite unobserved, to the disadvantage of the user, who has to be content with small profits where large ones are possible.

There are records unlimited to prove that in actual practice, electric driving can be very economical. Take one case—well known amongst electrical engineers because it was closely watched for results—that of the world-known firm of Richardson's, Hartlepool, Eng. They had 27 steam engines driving their works. These were taken out and a much larger number of smaller motors installed. The result was a net saving of 40 per cent. after making all allowances.

In practically every case where economy is not effected it will be found to be due to an unsuitable system of distributing the power, or the employment of inefficient gear, or of unsuitable types of motors. The points, therefore, which should be considered are: first, the source from which power is obtained; second, the methods of driving; third, the types of motors to be employed; fourth, the avoidance of the little things which militate safety, economy and general reliability in working.

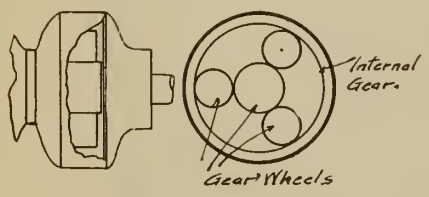



Fig. 1.—An Efficient Form of Reduction Gear for Direct Coupling. Slow Shaft in Line with Motor Shaft.

In the case of large works, where the amount of power used is considerable, it is usually most economical to install a complete generating plant. But for smaller factories, especially where power is procurable at a low price, it is generally advisable to obtain power supply from the central station.

### Three Methods of Applying Power.

There are three general methods of applying the power, viz.: the single-unit system, where one motor drives the whole factory; the group system, where the whole machinery is divided up into small groups, each group having its own motor; and the individual motor system where each machine is driven by its own motor.

Excepting in the case of small shops where the total amount of machinery and of power used is small, the adoption of the first named method is nearly always a mistake. Power has to be carried from the motor to the driven machines by means of shafting, gear wheels and belting, all of which dissipate energy. It has been found that in many cases the loss amounts to 40 per cent., and in some cases as much as 68 per cent. of the power output at the motor. Again, this loss is far greater in proportion to the actual work done, when only part of the machinery is being used.

Grouping: In the case of small machines, each taking but little power, it is usually advisable to arrange them into small groups, several such machines being connected by belting and shafting as the circumstances may dictate, and having a separate motor for each group.

This eliminates the question of excessive first cost, which would have to be met if individual motors were used throughout. In such circumstances as mentioned its economy factor is very satisfactory. Amongst other cases where this method is correct the following may be taken as examples, viz.: the ruling, paging, stitching, punching, scoring and other small power machines used in the paper trades; separate lines of sewing machines in clothing works; and small drills, hacksaws, and the like in machine shops. It must be borne in mind, however, that the adaptibility of this method is limited exclusively to such instances as quoted.

The individual motor system: Save as mentioned above, this is by far the most economical method. It is also the most convenient, and, in the majority of cases, the only desirable way. Against the first cost of the motors, the absence of shafting and belts must be considered. But the question of cost is fully outweighed by the great advantages obtained.

### Methods of Attaching Motors to Machines.

Generally speaking, the motor should be coupled directly on to, or geared into, the driven machine. This applies especially to such cases as the following, viz.: printing machines (particularly litho machines and those like the larger "Wharfdale" and "Meihle") printers' guillotines, paper-making machines and calendars; woodworking machines (particularly such as circular saws, planers, spindle shapers, and the like); spinning machinery and looms; and all machine shop tools, save the smallest. For the heavier kinds of machine shop tools direct coupling is, of course, indispensable.

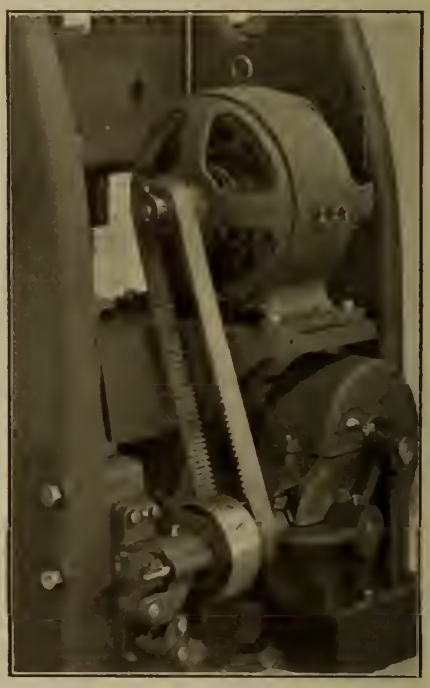


Fig. 2.—Chain Drive on Vertical Boring Mill.

A case which came under the notice of the writer recently will serve to illustrate. Motor had a belt drive to a line of shafting, which, with countershafts, ran two circular saws, bandsaw, three boring machines, small mortising machine and planer. The motor was built for 15 h.p., and should have been sufficient, but for the gear, but was found

to be overloaded. Eventually separate motors were installed, one for the planer, one for each saw, and one for the remaining machines, which were all connected to one short length of light shafting. The result, after allowing for interest on the outlay involved, showed an economy to the extent of nearly 30 per cent. of cost of electricity.

The method of attaching motor to machine is of great importance. Where possible, and particularly for high-speed machinery, the motor shaft should be coupled directly on to the machine shaft. But for other cases circumstances must dictate. Two methods worthy of special attention are those shown in Figs. 1 and 2: both are for speed reduction and both have been found to give satisfactory results. The "silent chain" drive needs no explanation. In the gear shown in Fig. 1 a pinion on motor shaft gears into three or more small gears, which in turn are geared into a larger wheel with internal teeth, this being keyed onto slow shaft. The housing for the gear is used as a base for the intermittent wheels (which should be of raw-hide) and also as a bearing for the slow speed wheel and shaft. This, if well made, forms a very efficient gear; the slow shaft is in line with motor shaft, and whilst a reduction of 20 to 1 is easy, there is practically no limit to its adaptibility.

### Types of Motors to Be Used

We next come to the question of the type of motor,—whether for direct (continuous) current, or alternating current? If the former, whether series, shunt, or compound wound; and if the latter,

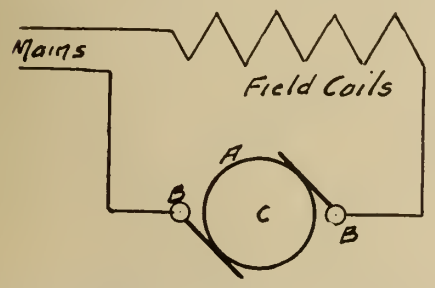



Fig. 3.—Series Wound Motor. A, Armature ; B, B, Brushes ; C, Commutator.

whether single phase or poly phase?

It is generally conceded that the D.C. motor is the most useful for general purposes, though it is closely pressed by the polyphase motor. An efficiency of 90 per cent., or even higher, may be attained with a D.C. multipolar motor of best design and manufacture—and it may safely be asserted that a cheaply-made motor is always very costly.

Series wound motors have the field coils, armature coils and external circuit all in series with each other, as in Fig. 3. The special features of such a motor are as follows' The "torque" (or "turning moment"—the "pull" of the armature) is greatest at starting; the speed varies inversely with the load, the current directly following the load. At light load it takes but little current, and runs at high speed. At heavy load the conditions are just the reverse — slower speed and greater current. Its high starting torque makes it specially useful for elevators, cranes, traction,

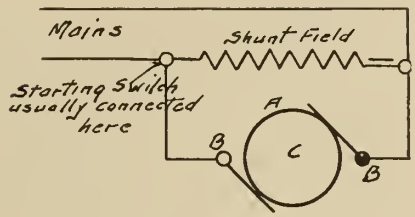



Fig. 4.—Shunt-Wound Motor.

coal-cutting, organ blowing and similar duties; but it is quite unsuitable for purposes where constant speed is required.

Shunt-wound motors are by far the most generally met with, since these are suitable for the majority of machinery requirements. The field coil of a shunt motor is connected across the armature (Fig. 4), and the one special feature about such a motor is its constant speed at all loads, provided that the supply voltage be constant. If provided with a suitable starting resistance it will start up against load, but its torque is smallest at starting and greatest at full speed. It is suitable for running lathes, drills and most machine tools; for woodworking, printing and weaving; for fans, sewing machines, and in short, for every case where the load is steady and constant speed is required.

Where the load is jerky, or where frequent and sudden stopping and starting occurs, but where regular speed is also necessary we get the compound-wound motor, which combines, broadly speaking, the advantages of the series and shunt windings. A reference to diagram (Fig. 5) will show how this is achieved.

The field is made with two coils, one in series with the armature, the other in parallel, as in the shunt motor. It has a high starting torque; if well designed it will efficiently maintain a perfectly regular speed on intermittent loads, even in cases where sudden thrusts are entailed, and will work at considerable overload when necessary.

Compound motors are largely used for elevators, though some engineers use series machines for this purpose. They are also largely used for pumping, and for direct coupling to motor mills, shearing and punching machines and all cases where the machines are very heavy and consequently great starting effort is called for.

### Alternating Current Motors.

We now pass to the question of alternating current motors, single phase and polyphase. But first of all, a little explanation as to the terms "alternating" and "phase."

In a dynamo, the armature revolves in a magnetic field, each armature coil passing, in rotation, first the north and then the south pole. The result would be a current varying in direction but for the presence of the commutator, which rectifies it. In the alternator, however, no such rectifying arrangement exists, the coils of the armature, or "rotor" being connected with exterior circuit by means of collecting rings.

The stationary magnet coils Fig. 6) are excited with a direct current from a dynamo. When rotor is in motion an induced current will be set up in the secondary coils (Fig 6) attached to rotor. But as each secondary coil passes through alternately a "north" and "south" magnetic field, the current in each coil will vary in direction. Commencing from O it will rise to positive as the coil comes directly opposite to the first primary coil, then as the coils pass, dropping to O again, and when the next coil is reached, going to full negative. This would be a single-phase system, and is illustrated by the curve p in diagram—(Fig. 7).

A complete "cycle" or period is covered as shown in diagram, from c to c,

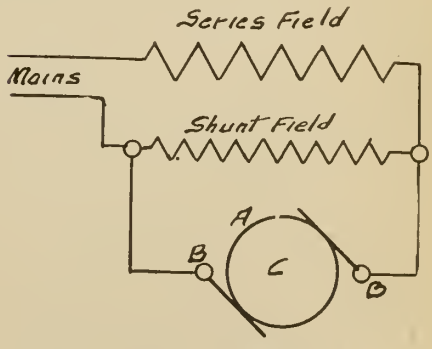



Fig. 5.—Compound-Wound Motor.

and it will readily be seen that the number of such cycles per second is dependant upon the speed of the machine and the number of coils.

Observe, however, that there is a point in each "cycle" when the coils in rotor are not opposite to any primary coils. Now, suppose we insert another set of coils, separately connected, in the spaces between the secondary coils shown in Fig. 6. Then we shall have a second current set up in these coils as they come into position, and as well as the curve p we shall have p2. This

would constitute what is known as a 2-phase system. By proceeding further in the same way we may get a 3-phase, or even 5-phase system.

The history of the rapid development of alternating current machinery is most interesting, but we are not so much concerned with that here. At the present day A.C. motors are of the "induction" type. A current is passed through the stationary coils in the field or "stator," and an induced current is set up

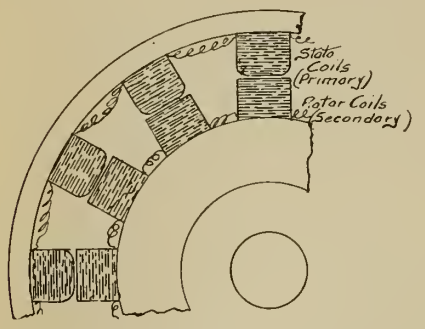



Fig. 6.—Arrangement of Coils in Single Phase Alternator.

in the "rotor," in consequence of which there is a reciprocal "pull."

Unless provided with slip rings or other devices, A.C. motors are of simple construction: there are no moving parts in connection with the external circuit, and save for the bearings and journals, no parts subject to wear and tear.

But the single-phase motor has some important drawbacks. It will not start up with any load—often a serious impediment, and one which in every case makes it an impossible motor for direct coupling. This limits its usefulness. Also it will not take an overload. Some English manufacturers meet this difficulty by underrating, e.g., a 5 h.p. motor will be marked and sold as 4 h.p., in which case an apparent overload is possible. But when a load is applied which is beyond its true capacity, the stress upon the motor will cause it to slacken speed. Now, it depends upon the speed for induction to take place at the right moment, corresponding with the "cycles" or periodicity of the circuit. Consequently, loss of speed throws it "out of step", the rotor loses its "pull," and stops.

The starting difficulty can be modified, however, even if not eliminated, by the introduction of some device which throws an added resistance into the rotor circuits at starting, and so increases the initial torque. This allows the motor to be started against some load. The magnitude of other troubles will largely depend upon the quality of design, workmanship and material in the motor itself. Once again, don't buy a cheap motor.

The polyphase motor is of modern introduction. A very few years ago it was scarcely thought of; to-day it is not simply an accomplished fact, but its adoption has become more general than was ever anticipated. The principles of its construction are much the same as in the single-phase motor, with the difference in windings corresponding to the difference between single and polyphase alternators, as already explained.

The difference in performance, however, is marked. It may be broadly stated that the polyphase motor combines the characteristic properties of the shunt-wound D.C. motor with those of the single-phase A.C. motor, without their disadvantages. It will start up against full load, will stand considerable overloading, will maintain a speed nearly constant, whilst it has no commutator or other moving contact parts, and the absence of wearing parts; consequently motors of this type have a great field and there are but few drives for which they may not be employed.

One more consideration is necessary. The life of the motor must not be too short or its repair costs too great. The frame should be designed not for cheapness, but to protect the windings, etc., as much as possible. It should be securely bolted to a solid foundation. Where direct coupling is adopted, the frame of motor should be secured rigidly to frame of driven machine.

The motor should also be protected as far as possible from dust, and especially from damp. It is an old and incontrovertible axiom that "dirt and damp destroy electrical machinery." Perfect lubrication and frequent and thorough cleaning of the motor is necessary. Sometimes—very seldom—it is necessary to apply a little vaseline to commutators, but don't pour oil upon them, or let them become perceptibly greasy.

**A Few Don'ts in Motor Operation.**

Don't use cotton waste to wipe commutators with. Use a clean cloth.

Don't use emery on your motors at all. If it is necessary to clean commutators, use fine sand paper and polish with a piece of pine.

Don't overload your motors, it's bad policy everyway.

Don't have stiff or tight belts, or "lumpy" joints in your belts.

Don't let brushes press too heavily, or commutators will be worn into ruts.

Don't alter or remove brushes whilst current is on.

Don't let your motors become the resting places for "odds and ends."

Don't allow inexperienced persons to tamper with them, but don't neglect a fault until your motor suddenly burns out. As soon as undue sparking, heating or vibration is observed, call in a competent electrical engineer and let the fault be remedied, or it will certainly increase. A stitch in time saves nineteen.

---

**CASTLES IN THE AIR.**

A large part of the population is waiting for its ship to come in.

About every other man you see, and most of the women, are living in the future.

People who haven't the ability or the prospect of meeting next month's rent, enjoy beautiful apartments in an air-castle.

Hope—which is nothing more than a manifestation of the universal desire to live—becomes for a great many of us a soporific.

Now is the time. "Make good to-day—to-morrow you may not have the chance."

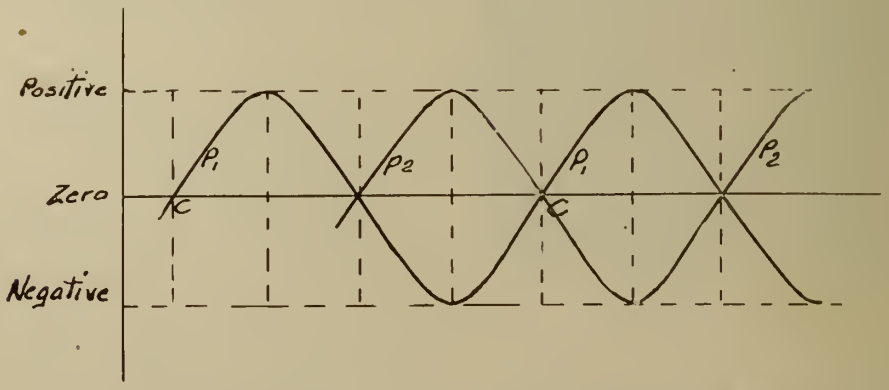



Fig. 7.—Alternating Current P.P.-Phases 1 and 2. C to C One Cycle or Period.

Living in an air-castle is about as beneficial as a meal eaten in a dream.

Wasn't it Cervantes who said that by the road of Bye-and-bye you get to the town called Never?

Beware of the man who is going to do things to-morrow.

He may mean well, but there's many a slip, and so forth.—Silent Partner.

# Consideration of the Air Leakage in Steam Condensers*

## Ability to Handle Air as Important as that to Condense Water—Formulas and Charts for Computing the Amount of Air Present.

By THOMAS C. McBRIDE

Experience has shown that the presence of a small amount of air in a steam condenser has a marked effect upon its capacity and efficiency. In spite of this no serious attempt seems to have been made to determine quantitatively the amount of air mixed with steam in ordinary practice, nor definitely to define or limit this amount to exact figures in condenser contracts and guarantees.

If it can be demonstrated that the greater part of the air coming to condensers is the result of air leaks, and that these leaks are mostly in the prime mover and its connections and likely to be but small in amount in the condenser itself; and if it is possible to devise some convenient method of estimating the proportions of the air to the exhaust steam required to be handled by the condenser, then it is only as fair to expect that purchasers' specifications shall at least limit the amount of air to be handled by the air pump, that the manufacturer may intelligently select the size of this pump, as it is to expect these specifications to state the amount of steam to be condensed, that the manufacturer may properly determine the size of the condenser.

In view of the one-sidedness of the usual purchaser's specifications in this regard, it is not surprising to find the manufacturer in turn stipulating that the prime mover and its piping shall be "free from air leaks" and then furnishing an air pump costing a very appreciable fraction of the total plant cost to remove air specified not to be present.

The author believes and assumes that the amounts of air passing through different condensers may be best measured and compared on the basis of the relation of the volume of this air to the volume of the steam being condensed, both being at the pressure and temperature existing in the particular exhaust pipe. The most convenient unit of volume is the volume of the water of condensation coming from the steam. The ratio of the volume of air passing through the air pump to the volume of water of condensation is then used to measure the air.

The most reliable index of the proportion of air to exhaust steam customary in existing plants is to be found in the rat-

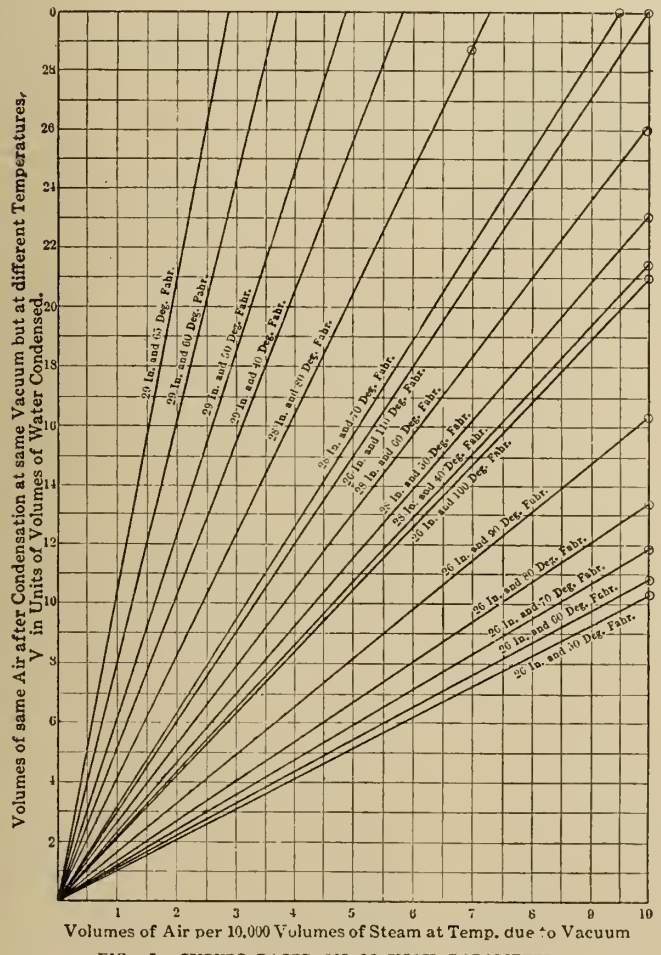

Volumes of same Air after Condensation at same Vacuum but at different Temperatures, V in Units of Volumes of Water Condensed.
29 In. and 45 Deg. Fahr.
29 In. and 60 Deg. Fahr.
29 In. and 70 Deg. Fahr.
29 In. and 80 Deg. Fahr.
29 In. and 90 Deg. Fahr.
28 In. and 70 Deg. Fahr.
28 In. and 110 Deg. Fahr.
28 In. and 60 Deg. Fahr.
28 In. and 80 Deg. Fahr.
28 In. and 100 Deg. Fahr.
26 In. and 90 Deg. Fahr.
26 In. and 80 Deg. Fahr.
26 In. and 70 Deg. Fahr.
26 In. and 60 Deg. Fahr.
26 In. and 50 Deg. Fahr.
Volumes of Air per 10,000 Volumes of Steam at Temp. due to Vacuum

FIG. 1. CURVES BASED ON 30-INCH BAROMETER

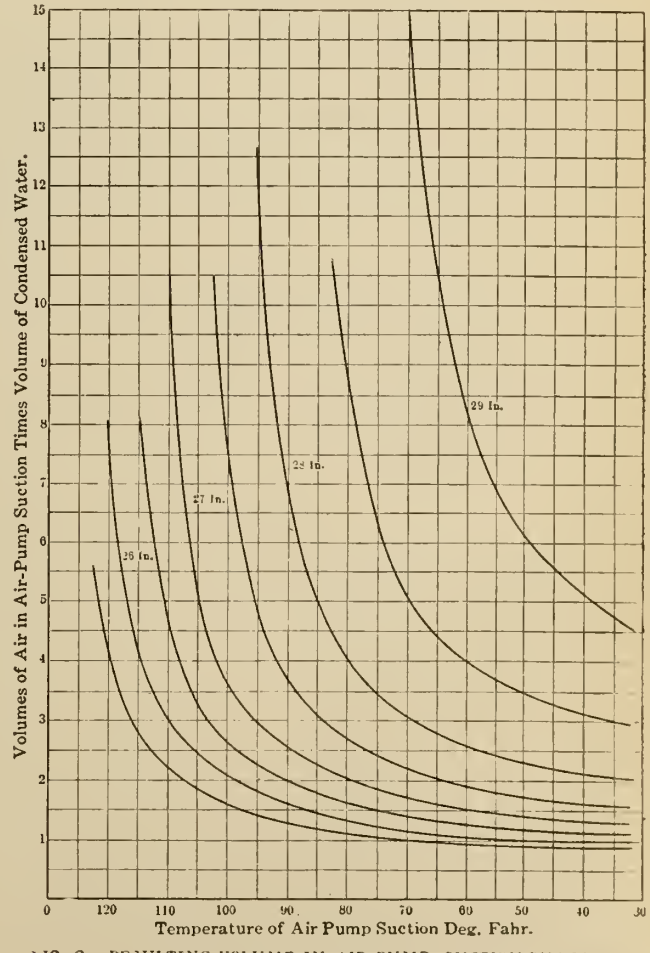

Volumes of Air in Air-Pump Suction Times Volume of Condensed Water.
29 In.
28 In.
27 In.
26 In.
Temperature of Air Pump Suction Deg. Fahr.

FIG. 2. RESULTING VOLUME IN AIR PUMP SUCTION DUE TO PRESENCE OF 1/10,000 PART BY VOLUME OF AIR IN EXHAUST STEAM

*Abstract of a paper read at the Detroit meeting of the American Society of Mechanical Engineers, June 23 to 26, 1908.

ings of air pump capacity in general use. Manufacturers of vertical twin air pumps and surface condensers usually guarantee them from 26 inches vacuum (30 inches barometer) and 110 degrees Fahrenheit, hot-well temperature, with 70 degrees injection and 110 degrees discharge temperature, under which conditions it is customary to furnish an air pump of a displacement about thirteen times the volume of the water condensed.

Presuming that the friction of the vapors in passing through the condenser is negligible and that the volumetric efficiency of this type of air pump is the same for the air as for the water, this rating presumes that for every unit volume of water of condensation there will be present in the air-pump suction pipe twelve volumes of air, saturated at 26 inches and 110 degrees, at which temperature the pressure of the steam alone is 2.58 inches absolute.

The twelve volumes of saturated air in the air-pump suction pipe is made up (Dalton law*) of

| | Inches Absolute. |
|---|---|
| 12 volumes of steam at ..... | 2.58 |
| 12 volumes of air at ..... | 1.42 |
| Total pressure ..... | 4.00 |

Reduced to the condition in the exhaust pipe, that its volume may be comparable to the volume of the exhaust steam, this air alone becomes:

$$12\times\frac{1.42}{4}\times\frac{459.5+125}{459.5+110}=437$$

volumes.

The unit volume of water passing through the air pump with this air was before condensation 11,000 times its volume. The proportion of air to 10,000 volumes of exhaust steam is, therefore,

$$\frac{4.37\times 10{,}000}{11{,}000}=40$$

volumes.

This amount, four volumes of air per 10,000 volumes of steam, represents the upper limit of the proportion of air to exhaust steam anticipated by American practice in air-pump guarantees for the class of steam plant usually supplied with vertical twin air pumps, as indicated by the success of large numbers of these pumps in achieving their rated results.

Horizontal air pumps for 26 inches vacuum and 110 degrees hot-well temperature are rated by most manufacturers as having a displacement of about 20 times the volume of the water of condensation. This rating presumes the presence of air in the proportion of 6.3 volumes to 10,000 volumes of exhaust steam.

Air pumps for jet condensers for 70 degrees injection and 26 inches vacuum, on the presumption that the discharge temperature will be 110 degrees, are usually rated at a displacement of 52 times the volume of the water of condensation. On these presumptions, this displacement will be made up of:

| | Volumes. |
|---|---|
| Condensed steam ..... | 1.0 |
| Air entering with steam through boiler ... ... ... ... ... ... ... | 0.3 |
| Condensing water ..... | 26.0 |
| Air entering with condensing water. | 10.5 |
| Air entering by leakage ..... | 14.2 |
| Total ... ..... | 52.0 |

Figuring as above, 14.2 volumes of air in the air-pump suction at 4 inches absolute and 110 degrees were, before condensation, 4.7 volumes per 10,000 volumes of exhaust steam, or to refer to the basis used before for the surface condenser, the air entering by leakage and in the boiler feed aggregates 14.5 volumes and corresponds to 4.8 volumes per 10,000 volumes of exhaust steam.

Here, then, are three different amounts, 4, 6.3, and 4.8 volumes of air per 10,000 volumes of exhaust steam, which the custom of air-pump guarantees establishes as the limiting proportions of air to exhaust steam in usual practice. The first of these values seems most reliable because of the high volumetric efficiency of the vertical twin air pump, but as this type of pump is most often used in steam plants, which, from their nature, are likely to have less leakage than the average plant, it is probable that 4 volumes is a little below the average. Neither of the other two values is likely to be as reliable as the first from the nature of the assumptions necessary in their deduction. It is, therefore, safe to say that provision to handle about 4.5 volumes of air per 10,000 volumes of exhaust steam at 26 inches is ample in steam-engine practice, and that more air than this indicates excessive leakage; this, however, depending somewhat on the size and type of plant.

Of the air that must be removed from the surface condenser, part enters with the steam through the boiler from the feed-water, the balance through leaks. If it be presumed that, as an outside figure, the feed-water contains 1-20 of its volume of air under atmospheric conditions and is at 70 degrees Fahrenheit, its relative volume, when it reaches the exhaust pipe entering the condenser, will be:

$$\frac{1}{20}\times\frac{459.5+125}{459.5+70}\times\frac{30}{4}\times\frac{10{,}000}{11{,}000}=0.38$$

volume per 10,000 volumes of exhaust steam; or if the feed be heated to 210 degrees before being pumped into the boiler:

$$\frac{1}{20}\times\frac{459.5+125}{459.5+210}\times\frac{30}{4}\times\frac{10{,}000}{11{,}000}=0.33$$

volumes per 10,000 volumes exhaust.

This shows that of the air-pump capacity presumed necessary by manufacturers, about 7 to 9 per cent. is required to handle the air coming into the condenser with the feed-water, and that the balance is required to remove the air entering by leakage and is largely an unnecessary expenditure. Certainly, then, the responsibility for limiting the amount of air is with the prime mover and its piping, and it is only reasonable to expect those controlling these features of the plant to indicate the amount of air the pump must handle and not to compel the condenser manufacturer to guess at it.

There seems to be no other means of measuring the air coming to any condenser than by the displacement of its air pump. The proportion of air mixed with the exhaust steam is so small that the temperature drop due to its presence could not be used. Thus, 4 volumes of air per 10,000 volumes of exhaust steam would cause a lowering of the temperature below that due to the pressure, of 0.014 degree Fahrenheit at 28 inches vacuum, and 0.015 degree at 26 inches vacuum.

Charts have been prepared to simplify the calculations necessary to determine the proportion of air and exhaust steam passing into the condenser, after the ratio of volume of water of condensation to volume of air passing through the air pump, and the temperature of this air, have been determined. The curves of the charts, Figs. 1 and 2, show the relations of these quantities. There are three sets of these curves in Fig. 1, for three vacua; the abscissas are volumes of air added to 10,000 volumes of steam and the ordinates are ratios of the volumes of this air saturated at the temperatures marked on each curve to the volume of the water of condensation. Thus, the curve marked 26 inches and 110 degrees Fahrenheit, shows that an air-pump displacement ratio of 12 volumes of air to 1 of water should, at this temperature and pressure, correspond to a mixture of 4 volumes of air and 10,000 volumes of steam at this same pressure, before condensation agreeing with previous calculation.

These curves are purely theoretical, and can be used for any type of con-

*Dalton's law as it relates to steam in condensers was explained by the author in a paper delivered before the Engineers' Club of Philadelphia.

denser to determine the ratio after condensation of the volume of air and water at certain temperatures which correspond to certain proportions of air mixed with the exhaust steam passing to the condenser, and can, therefore, be used for selecting both dry air-pump sizes and wet air-pump sizes where hot-well temperatures are to be guaranteed, and where the proportion of air to exhaust steam is either specified or assumed.

The curves also show the great influence of air-pump suction temperature on the capacity of an air pump to handle air. Thus an air pump with 4 inches absolute pressure can handle about twice the amount of air at 90 degrees it could handle at 110 degrees, and at 40 degrees about three times its capacity at 110 degrees. This feature of the curves also shows quantitatively the benefit gained in reduction of volume of air by the "dry" system, using a rotative dry-vacuum pump. Without sacrifice of hot-well temperature, this system removes the air near or at the temperature of the injection. If used on the presumed conditions of the vertical twin pump first mentioned, 12 volumes of air at 4 inches absolute and 110 degrees would be cooled to 70 degrees and become

$$12\times\frac{459.5+70}{459.5+110}\times\frac{1.42}{3.27}=4.85$$

volumes.

Referring to the curves it is seen that 12 volumes of air and 1 volume water at 4 inches absolute and 110 degrees, and 4.85 volumes air and 1 volume water at 4 inches absolute and 70 degrees, were each 4 volumes of air and 10,000 volumes of steam (both at 26 inches and 125 degrees) before condensation.

The curves also show, although not accurately, the fallacy of the short rule so often used which presumes that halving the absolute pressure will double the volume of air to be handled. As a matter of fact, the volume will be increased much more than twice if there is no accompanying temperature change, and at least twice, unless there is a very considerable accompanying temperature reduction.

As an example: Suppose a certain volume of air saturated at 70 degrees Fahrenheit (steam at 0.73 inch absolute) and 4 inches absolute, a usual condition in the suction pipe of a rotative dry-vacuum pump when maintaining this vacuum. This air has a pressure of itself of 3.27 inches absolute. If this volume be expanded to half the pressure and the air be still kept saturated at 70 degrees, the air pressure itself will be 2 inches—0.73 inch=1.27 inches, and its new volume will be

$$\frac{4-0.73}{2-0.73}=\frac{3.27}{1.27}$$

or 2.57 times the original volume.

The actual conditions may be represented thus:

One vol. saturated air at 70 deg. and 4 in. abs. = { One vol. air at 70 deg. and 3-27 in. abs. / One vol. steam at 70 deg. and 0.73 in. abs.

and becomes at 70 degrees and 2 inches absolute.

2.57 vols. saturated air at 70 deg. and 2 in. = { 2.57 vols. air at 70 deg. and 1.27 in. abs. / 2.57 vols. steam at 70 deg. and 0.73 in. abs.

If, however, in halving the pressure it is also cooled to 50 degrees Fahrenheit (0.36 inch absolute) the new volume will be

$$1\times\frac{459.5+50}{459.5+70}\times\frac{4-0.73}{2-0.36}=192$$

times the original volume.

$$\frac{2-0.73}{1-0.73}=47$$

times the original volume; or at 50 degrees (0.36 inch absolute) becomes

$$1\times\frac{459.5+50}{459.5+70}\times\frac{2-0.73}{1-0.36}=1.91$$

times the original volume.

All of these results are shown with fair accuracy (within 5 per cent.) on the curves, although the curves in the set for each particular vacuum were intended to be referred only to other curves in the same set and not to curves for any other vacuum.

If, then, it be decided, say, that 4.5 volumes of air per 10,000 volumes of exhaust steam shall be the permissible amount of air mixed with the exhaust steam in surface or jet condensers, the curves will show the volume of this air, and, consequently, the effective vacuum-pump capacity required for it for each vacuum and each air-pump suction tem-

TABLE 1.

RESULTS OF FOUR TESTS ON LARGE SURFACE CONDENSER.

| Test Number. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Ratio steam being condensed to guaranteed capacity of condenser for 70 deg. water and 28. in. vacuum, per cent | 74 | 67 | 38 | 27.5 |
| Vacuum in exhaust, 30 in. barometer, inches | 28.03 | 28.18 | 28.28 | 27.34 |
| Corresponding temperature, degrees F | 101.0 | 97.8 | 95.9 | 109.4 |
| Volumes exhaust steam times volume water of condensation | 21,200 | 23,100 | 24,600 | 16,000 |
| Steam condensed per square foot, pounds | 5.62 | 5.1 | 2.85 | 2.07 |
| Vacuum pump suction temperature, degrees F | 56.7 | 58 | 58 | 56.2 |
| Equivalent steam pressure, inches, abs | 0.46 | 0.48 | 0.48 | 0.45 |
| Air by volume in vacuum pump suction, per cent | 76.5 | 73.7 | 72.2 | 83.4 |
| Vacuum pump displacement times volume water of condensation | 52.6 | 58.0 | 105.0 | 143.5 |
| The same with 90 per cent. volumetric efficiency assumed | 47.3 | 52.2 | 94.5 | 129.1 |
| Volume air reduced to temperature and pressure in exhaust pipe times volume water of condensation | 39.6 | 40.7 | 73.3 | 118.0 |
| Volumes air in exhaust steam per 10,000 volumes exhaust steam | 18.7 | 17.6 | 29.8 | 73.7 |

TABLE 2.

RESULTS SHOWING EFFECTS OF AIR MIXED WITH STEAM.

| Test. | Nest of Tubes. | Steam Temperatures. Entering. (?) | Steam Temperatures. Leaving. (?) | Steam Temperatures. Average. (?) | Water Temperatures. Entering. | Water Temperatures. Leaving. | Water Temperatures. Average. | Difference Temperatures Inside and Outside of Tubes. (?) | Steam Condensed per Sq.Ft. per Hour. | B.t.u. per Hour per Sq.Ft. | B.t.u. per Hr. per Sq.Ft. per Degree Difference. (?) | Air in Steam by Volume Per Cent. (?) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | top | 101.0 | 91.1 | 96.0 | 56.0 | 66.0 | 61.0 | 35.0 | 12.03 | 13020 | 372 | 6.0 |
| | middle | 91.1 | 63.6 | 77.3 | 53.0 | 56.0 | 54.5 | 22.8 | 3.60 | 3888 | 171 | 51.0 |
| | bottom | 63.6 | 55.3 | 59.4 | 52.0 | 53.0 | 52.5 | 6.9 | 1.20 | 1296 | 189 | 75.0 |
| 2 | top | 97.8 | 91.7 | 94.8 | 56.0 | 66.0 | 61.0 | 33.8 | 10.89 | 11760 | 348 | 14.8 |
| | middle | 91.7 | 62.0 | 76.8 | 53.0 | 56.0 | 54.5 | 22.3 | 3.24 | 3498 | 156 | 47.0 |
| | bottom | 62.0 | 56.0 | 59.0 | 52.0 | 53.0 | 52.5 | 6.5 | 1.08 | 1164 | 180 | 73.0 |
| 3 | top | 96.0 | 89.3 | 92.6 | 54.0 | 60.0 | 57.0 | 35.6 | 6.12 | 6609 | 186 | 14.0 |
| | middle | 89.3 | 59.4 | 74.3 | 53.0 | 54.0 | 53.5 | 20.8 | 1.02 | 1101 | 54 | 47.0 |
| | bottom | 59.4 | 55.6 | 57.5 | 51.6 | 53.0 | 52.3 | 5.2 | 1.44 | 1554 | 30 | 72.0 |
| 4 | top | 109.4 | 100.0 | 104.7 | 54.0 | 57.5 | 55.7 | 49.0 | 2.64 | 2851 | 58 | 16.0 |
| | middle | 100.0 | 62.0 | 81.0 | 54.0 | 54.0 | 54.0 | 27.0 | | | | 38.0 |
| | bottom | 62.0 | 54.4 | 58.2 | 52.0 | 54.0 | 53.0 | 5.2 | 1.50 | 1620 | 31 | 82.0 |

Similarly, a certain amount of air saturated at 70 degrees (0.73 inch absolute) and 28 inches becomes at 70 degrees and 29 inches

perature. In the case of the jet condenser, due allowance must be made for the air carried in by the injection water, an amount that can be predicted with a fair degree of accuracy, provided, of course, the water be taken from a quiet pool.

As an example of conditions often found, the results of four carefully conducted tests of a very large surface condenser on a steam turbine are shown in Table 1. Tests Nos. 1 and 2 were made one a little above and one a little below nominal rating of the turbine, and show from Table 1 that the air leakage in the turbine, piping and condenser based on ratio to volume of exhaust steam, was about four times the largest amount customary in steam-engine practice. Tests 3 and 4 not only show enormous leakage, but also that the total amount of air increased as the load on the turbine decreased; a usual condition in steam turbines.

It is interesting to note the effect of the large proportion of air mixed with the steam, particularly in the bottom of the condenser, on the heat-transferring capacity of the surface, as shown in Table 2. Certain of the steam-temperature readings of the test were liable to error through the impossibility of knowing surely that the thermometers were not influenced by water dripping on them from the colder tubes, so all of these and the values derived from them are marked (?). However, as these readings are the average of readings taken in two different parts of the condenser in each case they cannot be far wrong.

It is very evident from these tests that the middle and bottom nests of tubes are doing practically no work and that the reason for this is the large proportion of air in the steam surrounding them as is shown approximately by the last column of Table 2. The heating of the circulating water being largely prevented in all but the top nest of tubes, the efficiency of the circulating system is very low even at the larger loads; 14 out of a possible 46 degrees in one case and 14 out of a possible 42 degrees in another.

It is of interest to consider what must be done to improve the vacuum in this condenser. From the fact that the air-pump suction temperature in these four tests was within 4.7, 6, 6.4 and 4.2 degrees, respectively, of the injection temperature, it is inferred that the condenser is doing fairly well as an instrument for cooling, especially in view of the large proportion of air present. The fault can then be corrected only by decreasing the amount of air in the condenser either by taking care of the air leaks or by increasing the speed or size of the air pump.

To reduce the air in the condenser to the equivalent of 4.5 volumes in the exhaust pipe to 10,000 volumes of exhaust steam, would require that the air leaks shown in the four tests be reduced to 24, 25.5, 15.1 and 6.1 per cent., respectively, of their present values, or that the speed or capacity of the air pump be increased about four times at full load on the turbine, about 6.5 times at half load and about 16 times at three-eighths load. The full benefit that would result from this change is hard to calculate, as it affects so many different features of the condenser. The first effect would be to reduce to one-quarter the proportion of air in the air-pump suction pipe. As there is an ample amount of cooling effect, this change would not materially affect the air-pump suction temperature.

The curves show that with 70 degrees injection temperature, presuming that the air-pump suction temperature could not be more than 75 degrees, the vacuum with same load and same air leakage as Test 1 would be 2.5 inches, and with the leakage usual with steam engines would be equal to 1.3 inches. This excessive leakage was, therefore, causing a winter vacuum of 28.03 that ought to have been at least 29.1 inches and was likely to cause a summer vacuum of only 27.5 inches where it should have been at least 28.7 inches. The winter loss of fuel, due to the excessive leakage of this unit, averaged probably half a ton per hour.

It is to be regretted that there is not more information available on which exact estimates of air leakage can be made. There are turbine plants comparable in size with the plant cited above, in which the air leakage is less than we have assumed as the maximum allowable amount in steam-engine practice. One carefully conducted turbine test, which, however, did not include readings of air-pump suction temperature, shows that there could not have been more than about one-half of the maximum customary air leakage of steam-engine practice at a little below full load and a little above full load, respectively, on a steam turbine of the same size as the one tested with the results shown in Tables 1 and 2.

One of these condensers was handling eight times as much air as the other. Presuming that the same precedents were used in designing both, if one did not have too little area for the passage of the steam and a consequent friction loss, then the other had entirely too low a steam velocity and consequent low heat-transfer capacity of the surface and low efficiency of the condenser. Until the quantity of air to be handled by condensers with the steam is agreed upon in advance, condensers will continue to be designed from precedents based on obtaining guarantees even if the plants later develop to be quite leaky; high efficiency cannot therefore be expected even if the air leakage turns out later to be very low.

It must be evident that comparisons of results obtained in different plants and from different types of condensers cannot possibly be trustworthy unless the proportion of air for each case has been determined and due allowance made therefor. The amount of air present exerts a great influence on the relation between temperature and vacuum in the condenser; on the air-removing capacity of the air pump, and on the heat-transferring capacity of the surface or spray. The plant having the smallest air leakage might have an advantage sufficient to wipe out entirely the benefits that might be gained by any refinements in the design of condensers under comparison. Thus, a comparison between the condenser whose test is shown in Tables 1 and 2, having a cooler lowering the air-pump suction temperature almost to the circulating inlet temperature, and the unit mentioned later, with its cooler removed, the results of the two tests would have favored the latter, and it might have been concluded that cooling was of no benefit. The methods of measuring and comparing air leakages suggested in this paper would not only show this to be an erroneous conclusion and that air cooling was of great benefit to the unit, but it would also show the amount to be gained by such cooling.

The suggested measurement of the air coming to condensers necessitates the following readings:

1. Pressure in air-pump suction.
2. Temperature of air-pump suction.
3. Quantity of steam being condensed.
4. Effective vacuum-pump displacement.

For ordinary work and with properly built condensers, the vacuum in the condenser could be taken for the first reading, but for exact work the pressure and temperature should both be taken at the same point in the suction pipe. Determination of the effective vacuum pump displacement requires readings of the speed of the vacuum pump and an estimate of its volumetric efficiency from its indicator card. For barometric condensers and jet condensers with air pumps, certain allowances have to be made, requiring for their determination some previous practice with condensers of other types.

**Discussion.**

Charles A. Howard suggested that the condenser man be given the contract for the exhaust piping, which would put him in control of the leakage.

Mr. Heisler said that the old system makes the condenser man responsible for the whole outfit, over most of which he had no control. A little defect in a piston-rod packing will admit sufficient air to make a serious dispute, if not to cause a rejection.

# Economy in Air Compression: Methods of Accomplishing It

## Practical Explanation of Reasons for Cooling Air Cylinders, of Intercooling, and of Compressing in More Than One Stage.

By W. C. WAY, M.Sc. *

A perfect gas is one which when under constant pressure will have a rate of expansion exactly equal to the rate at which it absorbs heat; or for each given increment of pressure there will be an equal increment of heat. Although air is not a perfect gas, yet for all practical engineering purposes, it approximates closely to the above definition.

When air is compressed in the cylinder of an air compressor, the pressure in front of the piston varies as it is reduced in volume. At the beginning of the stroke the air is at atmospheric pressure and temperature, but as it is crowded into a continually diminishing space the pressure and also temperature is increased. The increase in temperature tends to increase or expand the volume of the air, or in other words, to secure the desired volume and pressure after the temperature has again fallen to initial temperature, it is necessary to carry the air to a higher mean effective pressure than it would be if there was no increase in temperature during the operation.

When air is compressed and the heat of compression is not removed, the compression is known as adiabatic compression. If on the other hand the heat produced is removed as rapidly as it is formed, the compression is isothermal. In the case of the adiabatic compression the volume of air delivered will decrease or the pressure will decrease as the temperature falls to that of the atmosphere. With isothermal compression the temperature is the same at the end of compression as at the beginning. Since it involves the expenditure of more energy to accomplish the same results in using adiabatic compression than it does with isothermal, it is easily seen that it is an advantage to remove as much of the heat of compression as possible. The actual results—obtained in practice are unfortunately nearer adiabatic compression than isothermal. Providing we do not increase the friction losses the economy of the air compressor will be proportional to how near we approach the ideal isothermal compression.

After lengthy experience modern practice now limits the employment of but two means of removing the heat of compression, namely, by water jacketing and intercooling between the different stages of compression. One of the older forms used to accomplish this result was to spray water into the cylinder during compression and utilize the latent heat of evaporation of the water.

By the spray injection process higher thermal efficiency may be obtained than by means of water jacketing, but there are a number of difficulties encountered which more than balance this increased efficiency. The water in the cylinder prevents proper lubrication. Impurities in the water also attack the walls of the cylinder, necessitating repeated reboring of the cylinder and other repairs. The hot air absorbs a great deal of the moisture and on cooling deposits this in the pipe line, which freezes

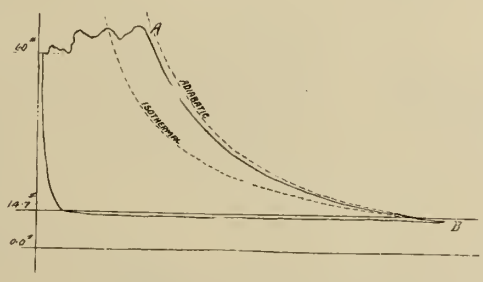



Fig. 1.—Indicator Card from Single-Stage Air Compressor.

up in cold weather, or in some cases if the air has not had sufficient opportunity to cool, it freezes at the exhaust of the motor, chocking the exhaust ports by reason of low temperature after expansion.

Removing the heat through the cylinder walls by circulating water is not satisfactory from the standpoint of efficiency. At the beginning of the stroke when the maximum amount of the cold cylinder walls are exposed, the air is at atmospheric temperature. As the piston advances and compresses the air the temperature rises, but less cylinder surface is exposed to the heated air. The temperature of the air continues to increase and the surfaces exposed decreases until near the end of the stroke when we have maximum temperature, there is practically none of the cylinder walls exposed and only the head exerts a cooling effect. Apart from the above, it is only the outer layer of the air that is exposed to the walls and as air is a very poor conductor, the greater part receives no benefit from the cool walls. But outside of this, jacketing is useful and indispensable as it keeps the working parts at a fairly low temperature, permitting lubrication and preventing the charing of the oils.

In Fig. 1 is shown an indicator card taken from a single stage air compressor, the dotted lines representing adiabatic and isothermal compression. If at one or more points in the compression from B to A the piston could be stopped and the air cooled by some means to its initial temperature and the compression then continued a more uniform and lower temperature would be maintained throughout the compression. The result would also be much nearer to isothermal compression. It is at once evident that it is impossible to stop the piston at different periods of the stroke; but by partly compressing the air in one cylinder, passing it through an intercooler, reducing the temperature to the initial temperature, the same practical results are obtained. In the second cylinder the air is compressed still further, and if high pressures are required three or four-stage compression with intercooling is employed.

Theoretically it would be an advantage to use compound or stage compression with low pressures. But the expense and complication of additional cylinders place a mechanical restriction on this possibility. The present practice among manufacturers of air compressors states 75 pounds as the limit which can best be obtained in single cylinders. Above this pressure compound compression is adopted, the number of stages depending on the final pressure necessary. High altitudes and expensive fuel would lower the limit above stated for single-stage air compression.

The most successful type of intercooler built to-day involves a nest of tubes through which cold water is circulated. The air is split up into thin streams and made to cross and recross the tubes by a system of baffle plates. The air and water flow in opposite directions, that is, the air, just before leaving the intercooler, is brought into contact with that portion of the tubes at which the cool water enters and thus reduces the temperature as low as possible.

* Consulting Engineer of Canadian Rand Co., Montreal.

In Table 1 is shown the power necessary to compress 100 cubic feet of air to various working pressures, using isothermal compression, one-stage, two-stage, three-stage and four-stage adiabatic compression. It does not need more than a glance to show the considerable saving obtained when we divide the compression into two or more stages, the difference being greater with the higher pressures.

TABLE 1.

Horse-Power Developed in Compressing One Hundred Cubic Feet of Free Air from Atmospheric Pressure (14.7 lbs.) to Various Gauge Pressures.

Initial Temperature of the Air in Each Cylinder taken as 60 Degrees Fahr. (Jacket Cooling Not Considered).

| Gauge Pressure | Isothermal Compression | Adiabatic Compression One-Stage | Two-Stage | Three-Stage | Four-Stage |
|---|---|---|---|---|---|
| 10 | 3.32 | 3 58 | | | |
| 20 | 5.51 | 6,23 | | | |
| 30 | 7.13 | 8 42 | | | |
| 40 | 8.42 | 10.26 | | | |
| 50 | 9.50 | 11.87 | | | |
| 60 | 10.42 | 13.31 | | | |
| 70 | 11.22 | 14.65 | 12.8 | 12.2 | 11.9 |
| 80 | 11.94 | 15.85 | 13.7 | 13.1 | 12.7 |
| 90 | 12.58 | 16.95 | 14.6 | 13.9 | 13.5 |
| 100 | 13.17 | 18.00 | 15.4 | 14.6 | 14.2 |
| 125 | 14.43 | 20.36 | 17.1 | 16.1 | 15.7 |
| 150 | 15.49 | 22.44 | 18.6 | 17.4 | 16.9 |
| 200 | 17.19 | 26.00 | 21.0 | 19.6 | 19.0 |
| 300 | 19.64 | 31.64 | 24.7 | 22.9 | 22.0 |
| 400 | 21.41 | 36.13 | 27.6 | 25.3 | 24.2 |
| 500 | 22.79 | 38.89 | 29.9 | 27.2 | 26.0 |
| 600 | 23.93 | 43.18 | 31.8 | 28.8 | 27.5 |
| 700 | 24.89 | 46.08 | 33.5 | 30.2 | 28.9 |
| 800 | 25.73 | 48.73 | 34.9 | 31.4 | 29.9 |
| 900 | 26.49 | 51.14 | 36.3 | 32.5 | 31.0 |
| 1000 | 27.20 | 53.37 | 37.5 | 33.5 | 31.8 |

When we use compound compression we raise the volumetric efficiency of the compressor. The air in the clearance space at the end of the stroke has to expand down to atmospheric pressure before air is admitted to the cylinder on the return stroke. The higher this terminal pressure the greater will be the expanded volume of air contained in the clearance. In compound compression the clearance space in the low pressure cylinder is the only one we have to consider. The final pressure in this low pressure cylinder is low usually not more than 25 lbs. gauge pressure when compressing to a final pressure of 100 lbs. gauge. While with single-stage compression the pressure in the clearance space is the working or final pressure.

Besides the above, the greater variation in pressure in single stage compression increases the liability to leakage through valves and glands of piston rods. When we compress air from 60 degrees Fahr. to a pressure of 100 lbs., in a single cylinder without cooling, which is practically the case in everyday single-stage compression, the final temperature will range from 475 degrees to 550 degrees Fahr. With this temperature great difficulty is experienced in lubricating the cylinders unless they are well water-jacketed. The passages will become clogged with gummy oil or cokelike material. The flash point of the most stable air cylinder oils do not as a rule exceed 450 degrees Fahr., so that this gummy oil or cokelike material is readily explained. The friction is increased by this inefficient lubrication, the wear on the moving parts becomes greater and leakage losses increase, due to sticking of discharge valves. Besides there is the danger of explosion resulting from a mixture of vaporized oil and compressed air. If on the other hand the compression to 100 lbs. pressure is carried on in a two-stage machine, the final pressure in the first cylinder would probably not exceed 25 lbs. with a corresponding temperature of about 233 degrees Fahr., a temperature which would not destroy the oils or produce the above mentioned results. The discharged air from the low pressure cylinder would pass through the intercooler and on entering the high pressure cylinder would be very near its initial temperature. The final temperature would not then vary greatly from that produced in the low pressure cylinder.

A further advantage in compound compression is the reduction of strain in the compressor. In a single-stage compressor having a cylinder 16 inches in diameter and compressing to 100 lbs., the piston area would be about 201 square inches. The terminal strain would be about 20,100 lbs. At 120 revolutions there would be a reversal of this strain 240 times per minute. On the other hand, in compound compression the difference between initial and terminal pressure in a cylinder is but a small part of the above strain. In fact, the working strains on almost every part of the machine is reduced.

To off-set these advantages named there will be the friction of the necessary additional mechanical parts in compound compression and also the friction of the air through the intercoolers and additional sets of valves, ports, etc. It is therefore important that the machine be carefully designed and properly built in order that these losses may be as small as possible. In a well-designed compound machine the friction will probably exceed that of the straight line by about 5 per cent., which is not serious.

The above mentioned advantages apply equally to compound compression, whether the machine is of duplex or straight line type. However, the most economical machines of to-day are of the duplex type. There are a number of important additional advantages to be gained by this construction. The word duplex as applied to a compressor implies that the machine is made up of two distinct but separate elements.

By setting the two crank discs with cranks on the shaft which unites the two elements at 90 degrees a much more uniform torque is obtained. The cross connection by means of the shaft allows the excess of power generated on one side to be transmitted to the opposite side when it is most needed. At the same time this construction makes better use of the flywheel. There are periods of the stroke, when the power will be greater than the demand, the heavy flywheel will store up this energy and deliver it when needed.

By making the cut-off one-half or greater we do away with any "dead centre," and the machine will start from rest or run at slow speeds when the demand for air is not large. On the other hand, the "straight line" machine will seldom run at less than one-third its normal speed, therefore, its minimum capacity is one-third of its rated capacity.

Compounding of steam and air cylinders is much easier accomplished, the parts being readily accessible and long piston rods are avoided. Compounding of the steam end, as well as the air end, results in a further economy, this combination cannot be successfully accom-

plished in the "straight line" types without complication of moving parts.

In selecting an air compressor, the conditions under which it is to operate must be carefully considered, as a single compressor will not successfully answer every requirement. A few of the important factors to be considered are, economy in operation, air pressure, quantity of air required, floor space available, character of machinery to be operated and first cost of the machine.

If a relatively small quantity of air is required, first cost is important, and economy of second rate importance, a straight line machine would be selected. On the other hand, if economy is of first importance, relatively large quantity of air required and other points of less importance, a duplex machine would be selected.

---

# Lighting and Power Equipment of Traders' Bank Building

## Plant Consists of Two 225 h.p. Vertical Enclosed Engines, Direct Connected to Two Three-wire Generators—Details of Switchboard Control.

A modern office building requires a power and lighting plant which shall be up to date and reliable as possible. The Traders' Bank Building, Toronto, is equipped with an electric generating plant representative of the best practice in power generation and transmission. The plant has a normal capacity of 335 k.w., consisting of two 225-h.p., 14x21x12 Robb-Armstrong cross-compound vertical enclosed engines, operating at 275 r.p.m., with steam at 150 pounds, direct connected to two 150 k.w. three wire generators with balanced coils, 250—125 volts.

The lighting and power is arranged on the three wire system, 110 volts for lights and 220 volts for motors. This type of lighting unit occupies a minimum of floor space, which is an important feature in this building, as floor space is very limited in the basement, where the engine room is situated.

The valves of the engines are double ported, perfectly balanced, with the clearance reduced to a minimum, making the engines very economical in steam consumption. The governors are of the Robb-Armstrong-Sweet type, which give extremely close regulation under all conditions. The shafts are solid steel forgings throughout with balanced cranks.

The oiling system consists of a positively-driven pump which pumps the oil from a reservoir in the base and distributes it through a double system of piping under a pressure of from 15 to 25 pounds to every bearing.

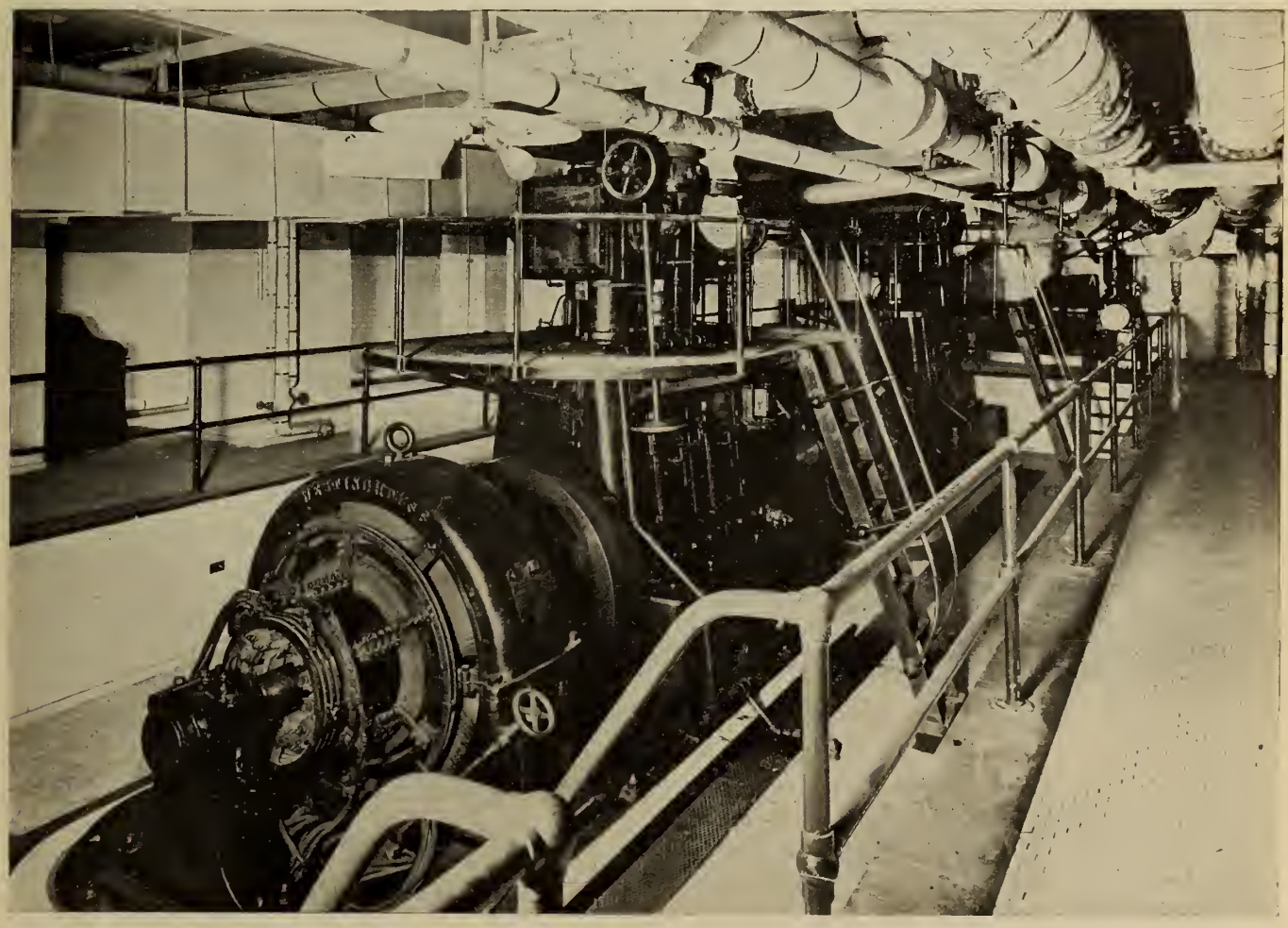


Fig. 1.—Two Robb-Armstrong Engines Direct Connected to Two 150 kw. Three-Wire Westinghouse Generators.

The three-wire generator mentioned consists of a standard 250 volt two-wire machine with the addition of four slip rings mounted on the shaft and connected to the armature windings at intervals corresponding to 90 electrical degrees. The voltage at the slip rings is two-phase alternating. The current is taken from the slip rings to a pair of balance coils, one coil to each phase. Each balance coil has a neutral wire connected to its winding midway between the ends. These are connected together and form the neutral of the three-wire direct current system. The two main leads only are carried through the switchboard proper, as will be described later, the neutral wire being taken direct to the balance coils and from there to the feeders. With these additions to the standard two-wire generator a voltage of 110 volts becomes available on either side of the neutral for the lighting circuits.

In this installation, mention might be made of the engine and generator foundations, which are only twenty-four inches deep, laid on four inches of sand to prevent vibration. At the same time there is no perceptible sign of movement either in engine, generators or piping.

In addition to the larger units, a small auxiliary plant is located at one end of the generating room. This unit is used at periods of light load, in the Winter between seven and nine a.m. and after 6 p.m., and in the Summer during the most of the day, also on holidays, etc.

This unit consists of a 35 k.w., 250—125 volt, three-wire Westinghouse direct current engine type generator, direct connected to a 10x10 Robb Armstrong horizontal side-crank engine, and is supplied with an independent switchboard for its control. The complete unit with its controlling switchboard is shown in Fig. 2.

Each of the three units, as previously mentioned, is equipped with two balancing coils of ample size to permit of an unbalance of 25 per cent. on either side of the neutral. These coils are not indicated on the accompanying illustrations, being located at the rear of the switchboards.

The main power and lighting switchboard is shown in Fig. 3. Panels No. 3 and No. 4 each control one 150 k.w. generator. Panels No. 1 and No. 2 are the feeder panels.

As the series field coils of the three-wire generator are divided in halves, one half being in each side of the circuit in order to properly compound should any unbalance exist, the protective devices and measuring instruments require special consideration.

In the switchboard each generator panel is equipped with two single pole circuit breakers with special equalizer contacts to insure the opening of all circuits in case of excessive load or short circuit. Two ammeters are essential for use with each generator as indicated on the illustration, so that the load on both sides of the system

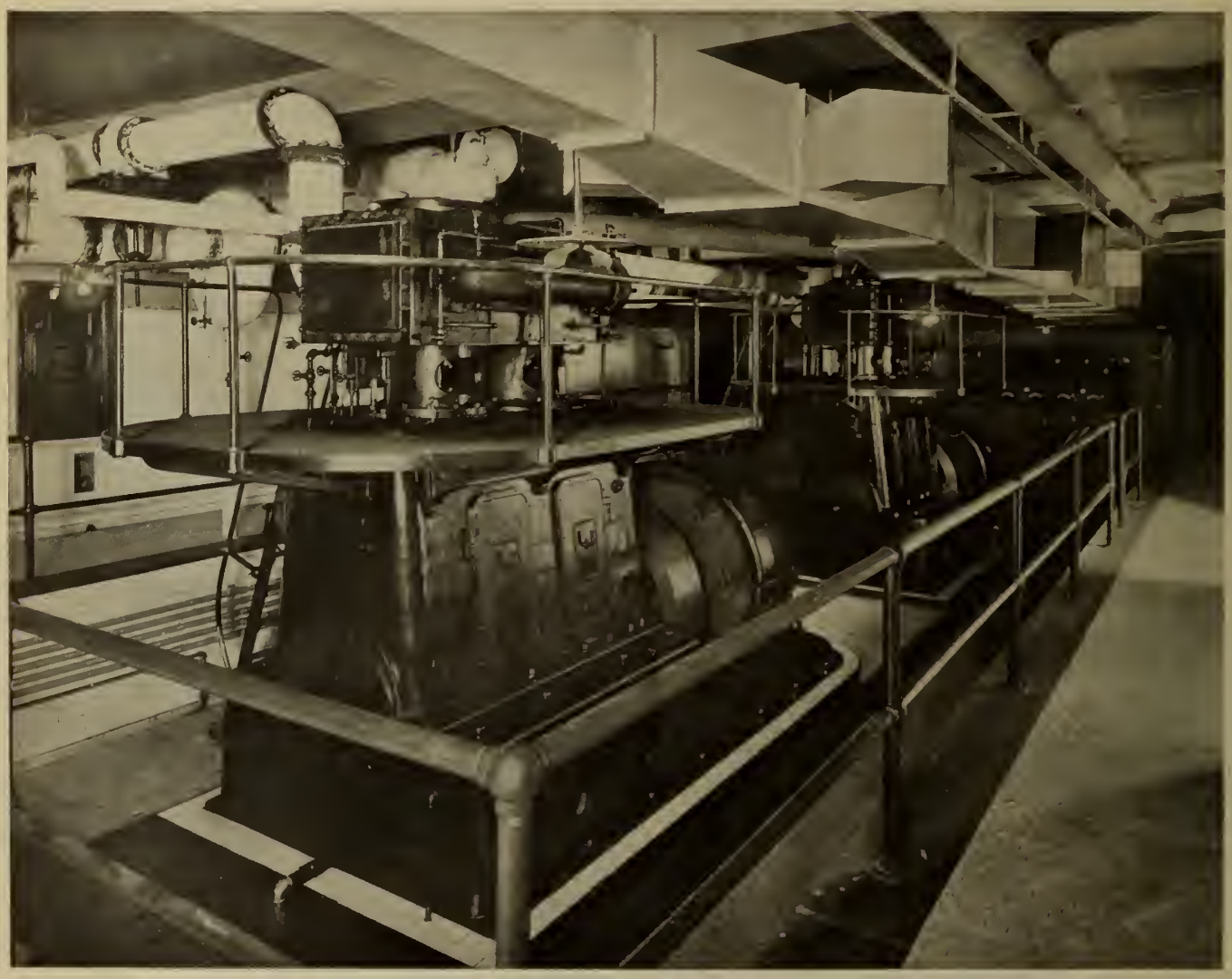


Fig. 4.—Traders Bank Plant. Two 225-h.p. 14x21x12 Robb-Armstrong Engines.

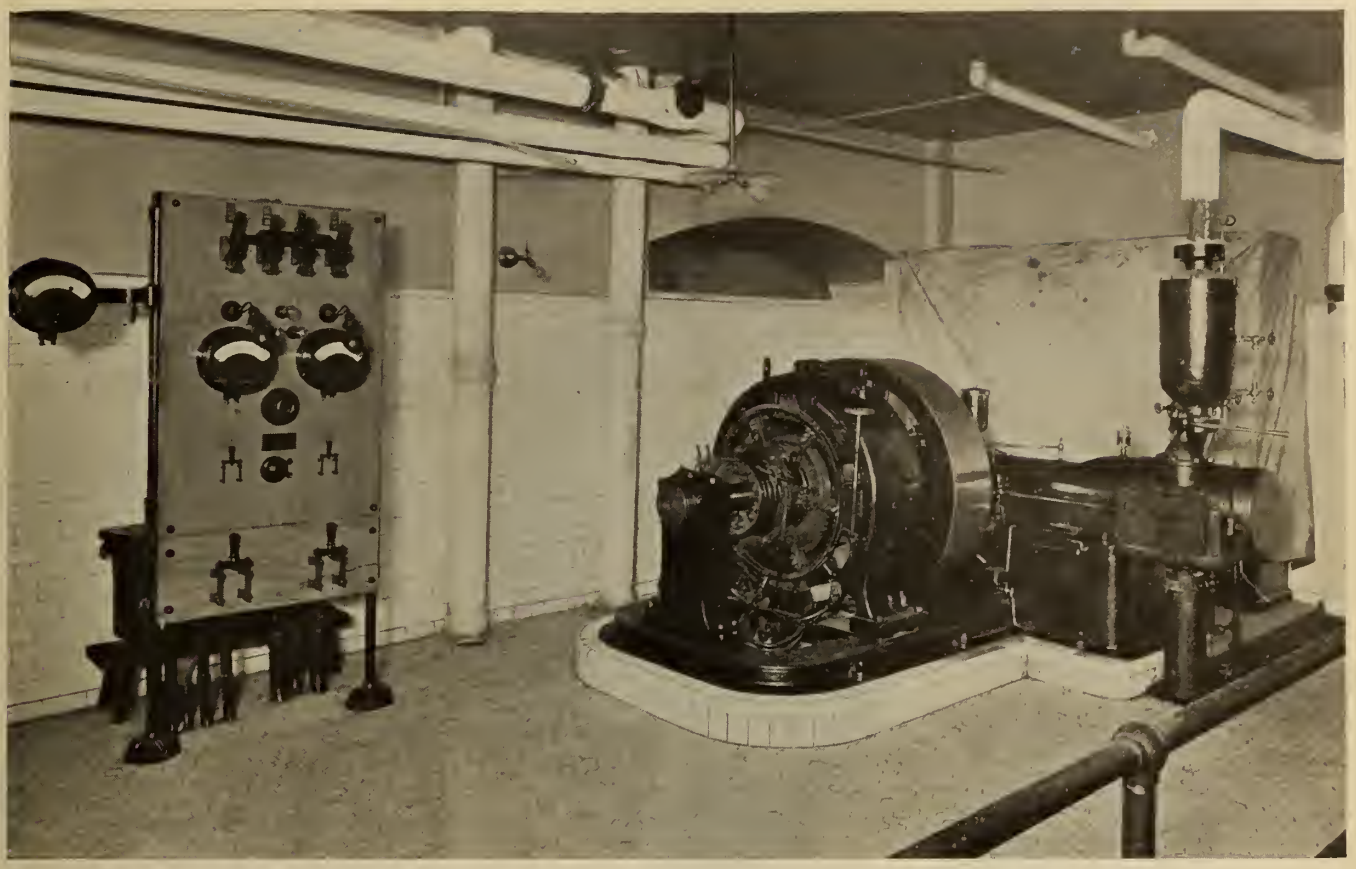


Fig. 2.—Auxiliary 35 kw. Robb-Armstrong and Westinghouse Generator Set.

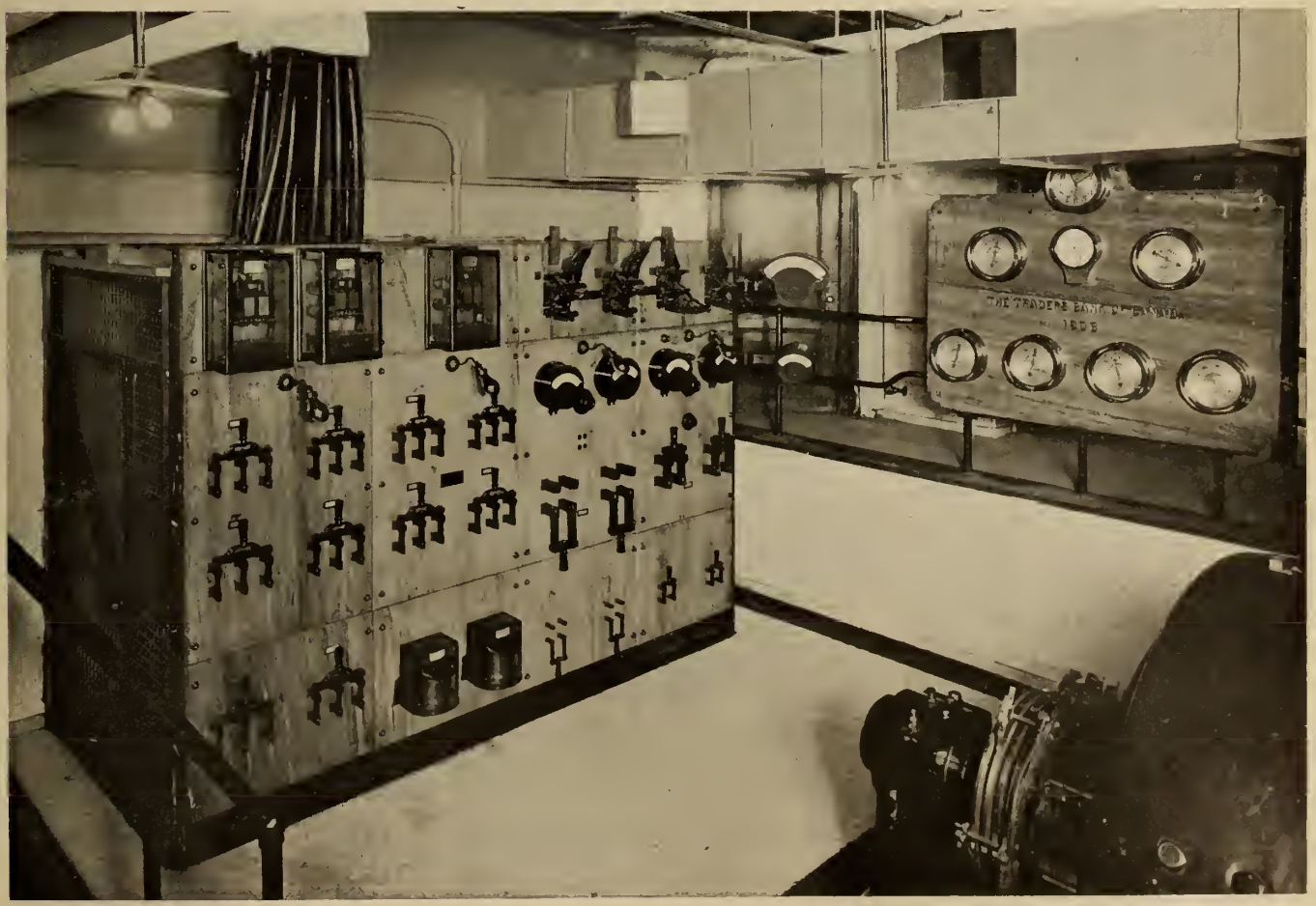


Fig. 3.—Traders Bank Plant, Showing t he Switchboard Arrangement.

may be observed and any unbalance noted.

In addition to these instruments two main double pole single throw switches are supplied, one for each main lead with its equalizer. On the sub-panel of these boards will be noted two two-pole single throw switches, which are connected to the balance coils to disconnect them in case of accident. On the extreme end of the board are mounted two voltmeters. The upper illuminated dial type is connected direct to the bus bars. The lower voltmeter is connected through the four-point voltmeter receptacles provided on the panels to either generator. It is necessary to thus supply two voltmeters to provide a means of paralleling.

There is installed on feeder panel No. 2 on the upper panel a 1,500 ampere 250 volt recording wattmeter to register the total load from the bus bars. Three pole main feeder switches are provided for the control of the various feeders in the building, there being 10 main feeder circuits. These are grouped into four sets of feeders, each set being taken through a recording wattmeter of proper size to register the wattage of each circuit. Two of these meters are shown on the sub-base of panel No. 2. The other two are mounted in the upper panel on panel No. 1. All the feeder circuits to the building pass direct from the rear of this switchboard to proper conduits in the ceiling, as shown on illustration. The main three-wire feeders are carried to junction boxes, one on each of the various floors, from which point the two-wire 110 volt lighting distribution is made as well as the 250 volt power circuit where required.

The small switchboard for control of the 35 k.w. unit is located at the other end of the power plant. The voltage from the main bus bars of the main control board is carried direct to this switchboard, the current of the generator being carried through its control switchboard to the bus bars of the main switchboard, at which point it is recorded at the wattmeters and then distributed to the building. There are, therefore, no feeder switches on this small panel, but it is equipped with the necessary circuit breaker with equalizer contacts, together with ammeter and main switch for each main lead. The illustration of this board also indicates the method of locating the balance coils at the rear of the switchboard panel.

The plant is under the control of Mr. J. Ross, chief engineer. The contract was taken by the Canadian Westinghouse Co., Hamilton, the Robb Engineering Co., Amherst, supplying the engines.

## STANDARD ENGINEERING CO.

Recently the Hare Engineering Co. was taken over by the Standard Engineering Co., consulting and contracting engineers, and manufacturers. They handle and manufacture steam specialties, stoker and furnace specialties, rail-

W. ALMOND HARE, B.A.Sc

way appliances, etc. Some of the contracts which this company have carried out have been with the Guelph Spring & Axle Co., the Montreal Rolling Mills, the Toronto & Belleville Rolling Mills, the Temiskaming & Northern Ontario Railway, the Toronto Railway Co., and others.

The manager of this firm is W. Almond Hare, B.A.Sc., graduate of the University of Toronto, in 1899. His experience was gained with the Illinois Steel Co., Joilet, Ill.; the Cambria Steel Co., Johnstown, Pa.; the Lackawanna Steel Co., Buffalo; the Rhodes, Curry & Co., Amherst, N.S., with which firm he was mechanical engineer, and with the Jones Underfeed Stoker Co., as chief engineer. He is an associate member of C. Soc. C. E.

The offices of this company are at 43 Scott Street, Toronto.

---

## NEW AUTOMATIC BOILER FEED REGULATOR.

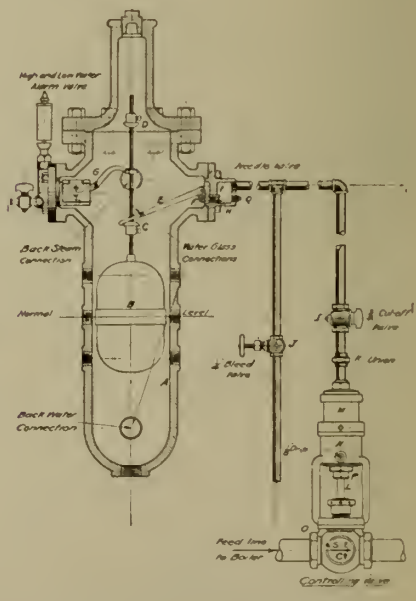
The accompanying illustration is of a new automatic boiler feed regulator which is being manufactured by the Standard Engineering Co., 43 Scott St., Toronto. As can be seen from the illustration, the regulator consists of the cast iron column A, which contains the float B, which rises and falls with the water in the boiler. As the water in the boiler is evaporated, the float gradually falls, taking lever E with it, thereby closing the valve F. This shuts off the steam pressure from the pressure pipe leading to the controlling valve, and the pressure within this pipe falls as the steam is vented through the bleed valve J.

As soon as the pressure falls, the spring in the controlling valve forces the piston upward and with it the valve stem L, thus opening the feed pipe to allow the pump to deliver water to the boiler, and to restore the water level to the normal position.

When the water reaches this point, the float with its rod and knocker, will have risen and be in contact with the lever E, which it raises slightly, thus opening the needle valve F, and allowing the steam pressure to enter the pipe line to the controlling valve and to act on the piston of the same. The piston is thus forced down against the spring and the valve is closed, shutting off the water from the boiler, and checking the rise of the water level.

The operation in this way is simplicity itself, and the liability of getting out of order is very slight.

As a guard against accident, a high and low water alarm has been added. Its operation is as follows: Should the controlling valve fail to open, the water will fall to a point 4 to 6 inches below the normal level, at which point the top knocker D will come in contact with the



Automatic Boiler Feed Regulator.

lever G, causing steam to pass through the alarm whistle, thus sounding for low water. Should the water rise above the normal level, lever E will be brought in contact with lever G lifting same slightly and giving alarm for high water.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## POINTS ABOUT SHAFTING.

By R. Manly Orr.

Next to the care and proper operation of the actual power plant, comes the care of the shafting which is to convey the power to the various points in the factory building where it is to be used. Recognizing this to be a fact, a great many superintendents have placed the care of their shafting and belting under the charge of their engineer, and I have come to regard the union of the power-developing and power-transmitting systems as an entirely fitting and proper combination. A friend of mine once said that when going on a very long bicycle ride, he paid just as much attention to the easy running of his wheel, as to the strength and fitness of his muscles. Just so, it may be that while the valves are all properly set in the engine room, the condition of the shafting out in the factory may be such that the power department economy will be considerably lessened.

Reference to the accompanying illustration Fig. 1 will explain a bit of shafting trouble which belongs to my present plant and comes as the result of faulty hanging.

A—Floor between 1st and 2nd storeys of the building.

B—Beams running lengthwise of building.

C—Larger beams running crosswise of building.

D—Posts supporting beams C.

E—Short crosswise timber for hanging hanger from.

G—Post hangers.

Now it happens that in one of the departments on the upper floor, at the point H, tons of material are alternately piled up on the floor and then removed. For some time the shafting K kept pulling out of the coupling J, and no amount of keying would keep it in for any reasonable length of time. After some watching I found that the beam B sagged down under the heavy weight above, and then sprung up again on its removal. This of course forced the shaft down during part of the time to the position indicated by the dotted lines. The effect produced on the coupling at J can easily be understood as being the same as that produced on a post in the ground when one walks about it pulling its top in different directions alternately.

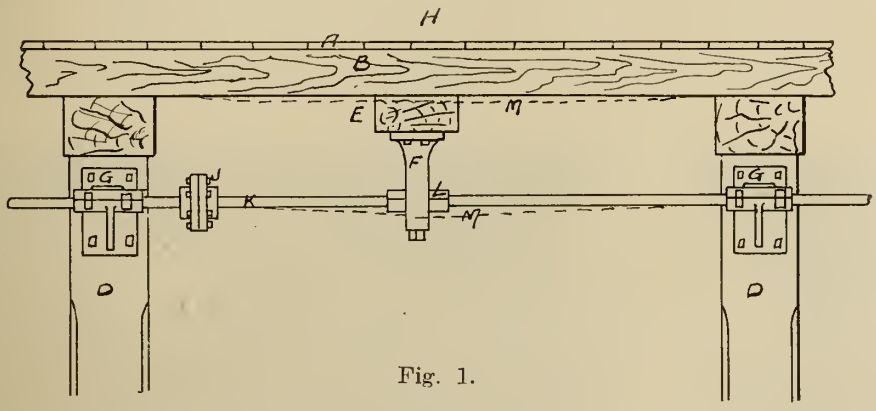



Fig. 1.

The trouble was overcome by removing the cap off the hanger box L, it being impossible to place a post under E, and there also being no belts running on that particular length of shafting.

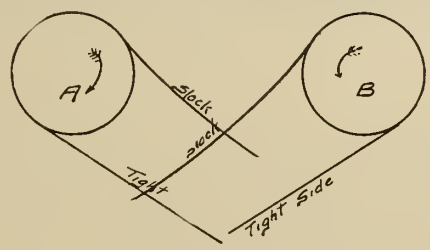



Fig. 2.

In installing shafting I would make it a rule to arrange for placing all hangers for shafting either at, or very near those beams supported by posts. Where heavy belts draw horizontally on the shaft, I would also advise the use of hangers in which the division of the journal was arranged at an angle of 45 degrees, and as the timbers shrank, I would closely follow up all nuts on hanger support bolts, lest the draw on the belts should pull the hanger sideways on its slotted holes and thus pull the shafting out of line. Then again, I would carefully avoid excessively tight belts. This I would do in three ways: First, by referring to Fig. 2, I would arrange my shafting so that as far as possible the slack side of all belts would be on top, which gives the belts a greater contact with the pulleys. If the shaft were to revolve as at A, then I would install the shaft in the position A, but if the shaft were to revolve as at B, then I would install the shaft in the position B. Second, I would use a liquid dressing on my belts so that they would be kept in a pliable condition. For this purpose, I would recommend the use of pure neatsfoot oil applied sparingly and often—one can soon see how much is needful. I know of two patented liquid dressings which have given me satisfaction. Third, I would use larger pulleys and high belt speeds. I would even go to the trouble of raising the sizes of pulleys where a belt was running excessively tight, and I believe I would be repaid in the end.

Now, in closing, let me say that I am not a lover of very slack belts, nor do I take any objection to a fairly tight belt. It is an excessively tight belt that I do not like. Let me here explain a little point that is not understood by some men I have talked with. Referring to Fig. 3 some roughly imagine that the horizontal strain on each of the two shafts when the load is on—the tension on both sides of the belt when the load is off—the extra tension on the tight side when the load is on. Now this is

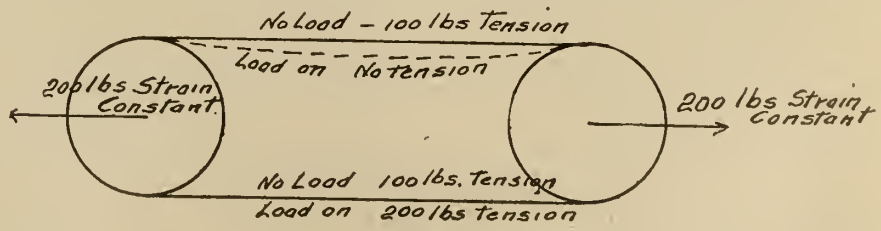

No Load – 100 lbs Tension
Load on No tension
200 lbs Strain Constant
200 lbs Strain Constant
No Load 100 lbs. Tension
Load on 200 lbs tension

Fig. 3.

a mistake, because the on-coming load only reduces the tension on the slack side and transfers it to the tight side without at all increasing the total strain on the shaft. No matter how tight any belt may be, and no matter what strain its tension may put on the shaft, if one side of it slacks down at all when under load, then there is only the strain due to the load, effective on the shaft bearing, and the original tension of the belt is lost. It can easily be seen by this that every belt can be kept so tight that it will just show slack under strain of load, and the shaft will not thereby be subjected to any strain above that due to the tension of the tight side in pulling the load.

Where belts were used in a way that left them running idle a very great part of the time, I would always use a fast and loose pulley of different sizes, with a bevel shoulder on the loose pulley rising to the size of the tight one. I would also use ring oiling bearings on shafting in preference to any other device.

## A CONTRACTOR'S ELECTRIC MOTOR.

(By W. A. T.)

The adaptability of an electric motor to all sorts of service is well illustrated in the two views of a direct current motor with a circular saw on the extended shaft. The motor only differs from a type "S" motor of standard Westinghouse design in that the shaft is somewhat larger and longer on the pulley end, and that a commutator and bracket is supplied on this end to provide a bearing nearer the saw. The motor speed may be varied from 1,125 to 1,800 r.p.m., to provide for various classes of work, with saws of different diameters. This motor is rated at 10 h.p.

It will be noted that a pulley has been installed on the extended shaft at the commutator end to act as a flywheel and also to provide a place for a brake. This latter is thrown on by means of a lever near the operator whenever it is desired to stop the saw quickly. The contractor has also installed a bladed fan on the pulley to blow air over the motor and throw the chips and sawdust away from the track and the motor. These cannot be seen in the illustrations.

In Fig. 1 a large circular rip saw is shown, taking a cut in a heavy oak timber to be used in dam wickets on the Ohio River. The material must finish 10x12. In Fig. 2 a groove cutter is shown in place. A cross-cut saw is also used by the contractor who owns the outfit

The motor is mounted on a frame with wheels which run on a short piece of track, that the saw may be fed through the work. Attention is called to the method adopted by the contractor to keep the track clear of sawdust. In front of all four wheels a flap of leather is arranged to rub on the track, which effectually clears away all material and allows the groove cutter to make a cut of even depth at all times.

Mounted on the frame which carries the motor is the switchboard panel with a field rheostat for adjusting the speed, a starting rheostat and a circuit breaker. As the motor must move back and forth the current is supplied through two short stretches of trolley wire on which the trolley wheels run, similar to the method used in a traveling crane.

From the illustrations it is apparent that the motor is not installed under ideal conditions, as the protection from the weather is none too good, but it shows to what purposes motors may be put. The entire outfit is intended by the contractor for portable service as current is supplied from a gas engine-driven generator which is also mounted for ready handling. There is also a small air compressor which supplies a pneumatic drill.

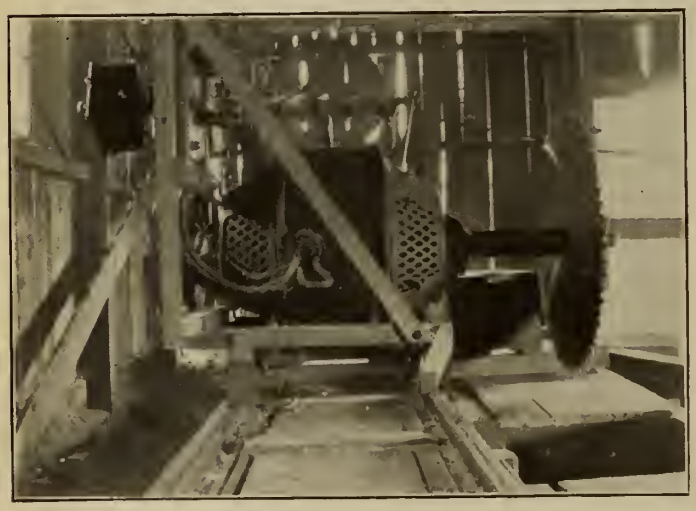


Fig. 1.—A Contractor's Electric Motor.

Fig. 2.—A Contractor's Electric Motor.

## THREE SAFETY VALVES.

(By W. W. Wakeman.)

Fig. 1 illustrates a lever safety valve as I saw it on a large new boiler. Somebody had evidently made a miscalculation, for, although the building was new, the ceiling was not high enough to show any space between it and the safety valve, consequently a slot was cut through this ceiling and the floor above, as shown. This boiler was set higher than necessary, making the furnace door high enough to be inconvenient for the average fireman. Probably the owner asked for and received the dimensions of this boiler before it came (for it was built in a city several hundred miles distant), but the height was calculated to the top of the dome, and the building was made high enough to clear this part, with a few inches to spare.

When the safety valve was put on, a slot was cut just large enough to allow the lever to work freely in it. This slot was enlarged at a point directly over the valve, also over the weight, but between these it was quite narrow. After the main steam pipe was put in place it was impossible to move the weight inward on the lever, as it was almost in contact with the first ell, therefore if it is necessary to set this safety valve for a lower pressure a smaller weight must be secured.

In many of our boiler rooms the head room is much less than it ought to be,

but this is the lowest that I have seen. It is possible to open this safety valve in order to show that it is not held fast by corrosion, but when it must be "ground in" to stop a leak, a larger hole must be cut for the purpose, and there are many plants where such improvements are never made until it becomes absolutely necessary, and this means after mismanagement has cost

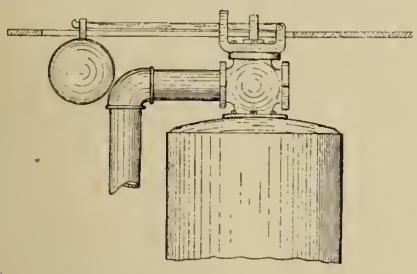


Fig. 1.

enough to pay for the improvement two or three times. This plant belongs in that class, hence it is not difficult to foretell the result in this respect.

How long will it be before somebody will pile stock on the floor in such a way that it will take about a thousand pounds pressure to the square inch to lift this material and open the valve?

In order to give this plant all of the credit that it deserves, I will call attention to the fact that the outlet of the safety valve is not piped, but is left so that steam can escape freely. This is one of the few cases where cheap construction is superior to more elaborate fixtures, as the following illustrations show:

Fig. 2 shows a safety valve placed directly on the shell of a boiler, but the main steam pipe is omitted. The outlet consists of a nipple about one foot long, followed by an ell turned upward, into which is screwed a pipe that extends through the roof and as much

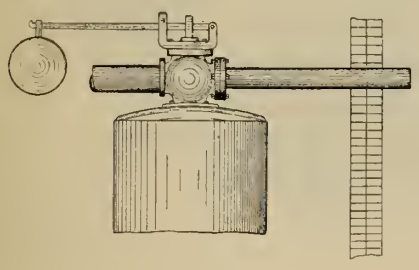


Fig. 3.

higher as the engineer's fancy dictates. The average safety valve leaks enough to keep this pipe hot at all times; but suppose that a valve should be perfectly tight. During a heavy rain storm this pipe will receive more or less water, and it is possible for this to collect until the pipe is full, and if it is 20 feet high it will assist in holding the safety valve to its seat to the extent of 8 pounds to the square inch, or, in other words, it will require 8 pounds more to the square inch to open it.

This may be an extreme case, but the idea of turning an outlet pipe upwards is never right, as it allows water to cause corrosion of the valve and other parts, which is not wanted. If for any special reason it is necessary to run this pipe upward, as shown, use a tee instead of the ell and put a drip pipe into it that will carry off the water before it reaches the valve, and if there is no valve in this pipe (which should not be less than ½ inch in diameter), it will never be closed accidentally or on account of mischievous design, thus rendering the pipe useless until the fault is discovered.

Fig. 3 illustrates a safety valve which appears to be properly piped, but it is not. In some cases it is necessary to carry as much pressure as the boiler will safely withstand in order to keep the engines up to normal speed, consequently if some of the load is suddenly removed the safety valve opens, and this may happen several times during the day. If this steam is objectionable in the boiler room, a pipe is carried through the nearest wall, as shown, and the steam is thus discharged outside of the room.

The illustration shows the safety valve on a boiler that I had charge of several years ago. The valve was four inches in diameter, but the outlet pipe was reduced to three inches. The grate under this boiler was five feet square, containing 25 square feet, and the safety valve opening contained 12.5 square inches, therefore for each square foot of grate surface there was ½ square inch of safety valve area, which agrees with a very good rule for designing safety valves for ordinary service.

However, when we consider that the area of a 3-inch pipe is only 7 square inches, the actual area of safety valve outlet is ¼ square inch for each square foot of grate surface, and this is not sufficient. I am aware of the fact that the actual lift of a safety valve, taken as it is found in ordinary practice, is low, but under common conditions the valve is only discharging surplus steam and is not working to its full capacity. The proper way to test a valve is to close all other steam outlets and then force the fire to its utmost capacity for generating heat. If the safety valve prevents the accumulation of a dangerous pressure its name is not misleading, but otherwise it is.

When a safety valve lifts from its seat the area of opening is small but the passage is very short, hence a comparatively large volume of steam will go through it, as full boiler pressure operates to force it out. After it has passed this point it expands rapidly. For illustration, take steam at 125 pounds gauge pressure, where one pound in weight of it fills only 3.18 cubic feet of space. As soon as this steam passes the safety valve and enters the discharge pipe it expands to atmospheric pressure, and one pound in weight now fills 26.36 cubic feet of space, or, in other words, it fills more than eight times as much space as before.

When taking this into consideration, also the fact that all steam discharged from a safety valve should be carried freely and with absolutely no back pressure to the outer air, it seems as if

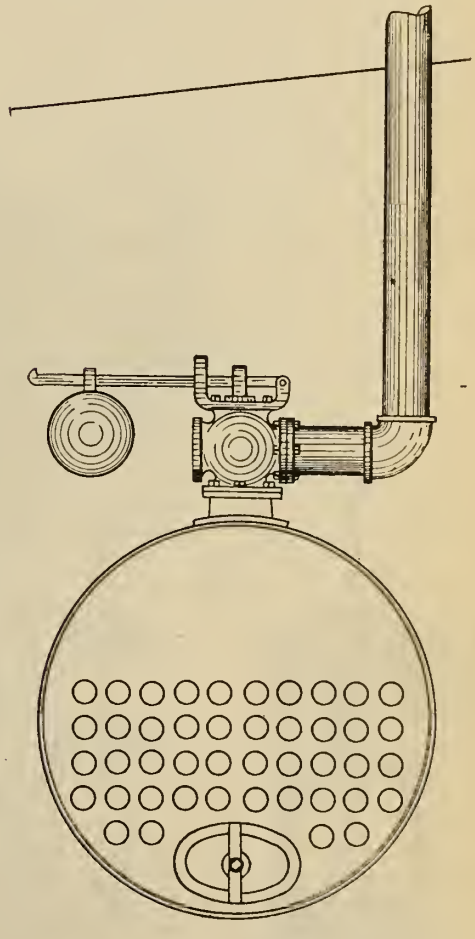


Fig. 2.

the discharge pipe ought to be larger than the valve. If it was increased to 5 inches in this case its area would be 19.6 square inches, or 56 per cent greater than the valve where it receives steam from the boiler. This is much more consistent than to make it smaller, and the increase is not excessive.—National Engineer.

---

Mr. Burnett, car construction staff of C.P.R., attended the convention of Master Car Builders' at Atlantic City.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### BERRY SAFETY FEED WATER REGULATOR.

The Berry safety automatic feed-water regulator, manufactured by the Berry Engineering Company, Chester, Penn., is combined with the usual water column and high-and-low-water alarm, thus making necessary only one machine on the boiler.

A seamless copper float, placed in the water column, responds to the variation of the water level in the boiler, and by means of a lever rotates the pilot-valve which controls the steam admitted to the feed or control valve, or to the whistle for the high-and-low-water alarm.

The water column is provided with internal longitudinal ribs which serve to guide the float to insure it against sticking, or interfering with the operation of the gauge and try cocks.

The feed or control valve is always wide open or tight shut, and does not wear from wire-drawing, and the diaphragm is supported by a flexible ring of steel plates that relieve the rubber of all strain. The pilot-valve, Fig. 2, is so constructed that it and its seat can be removed for inspection and cleaning while steam is on the boiler and while the column remains in service showing the water level in the glass. The action of this valve may be understood by reference to Figs. 2 and 3, the latter being a sectional view, showing the position of the valve when the water is at the level of the centre gauge-cock. When the nut H is about half-way removed, the internal valve K will close, and the plug G and the valve seat can then be safely taken out. The internal valve stem K engages the pilot-valve stem E and these parts rotate with the variations in the water level, the plug G remaining stationary.

A slight rise in the water above the set level will bring the steam to the pressure port B, and at the same time connect the pressure port C with the exhaust port A. A similar lowering of the water level will bring the pressure to the port C and connect the port B with the exhaust port A. In n ıal operation the variation never exceeds ½ inch, but if from any cause the water level should not be maintained, the steam would be directed to the whistle port D, blowing the alarm for either

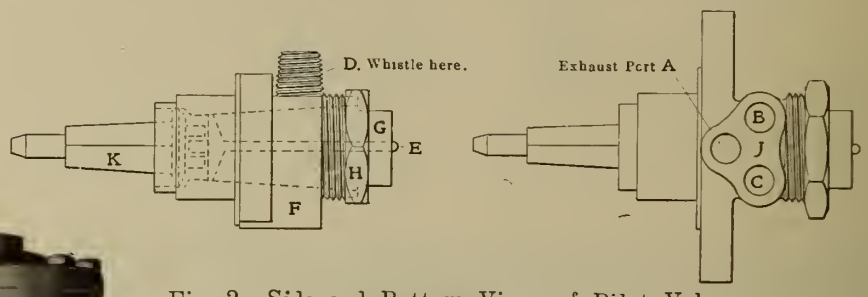



Fig. 2.—Side and Bottom Views of Pilot Valves.

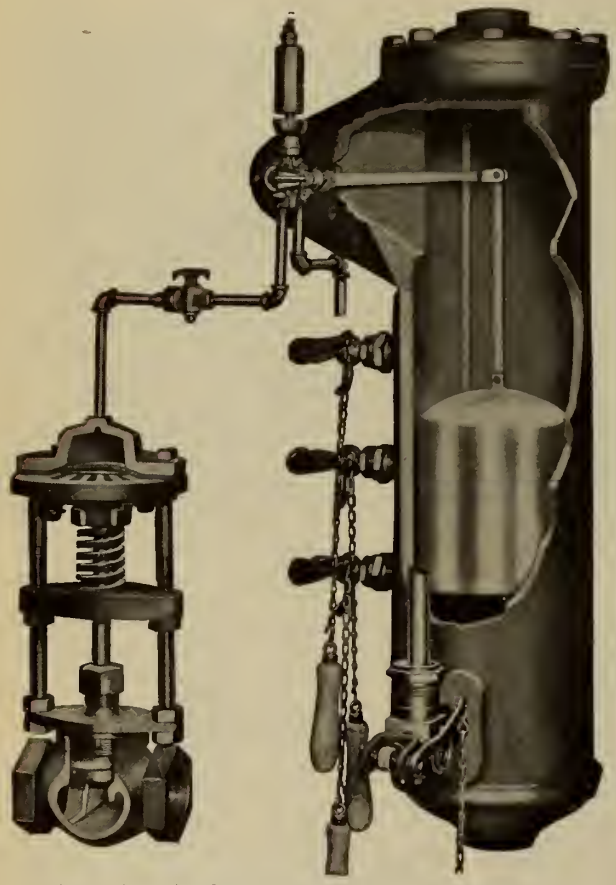


Fig. 1.—The Berry Feed-Water Regulator.

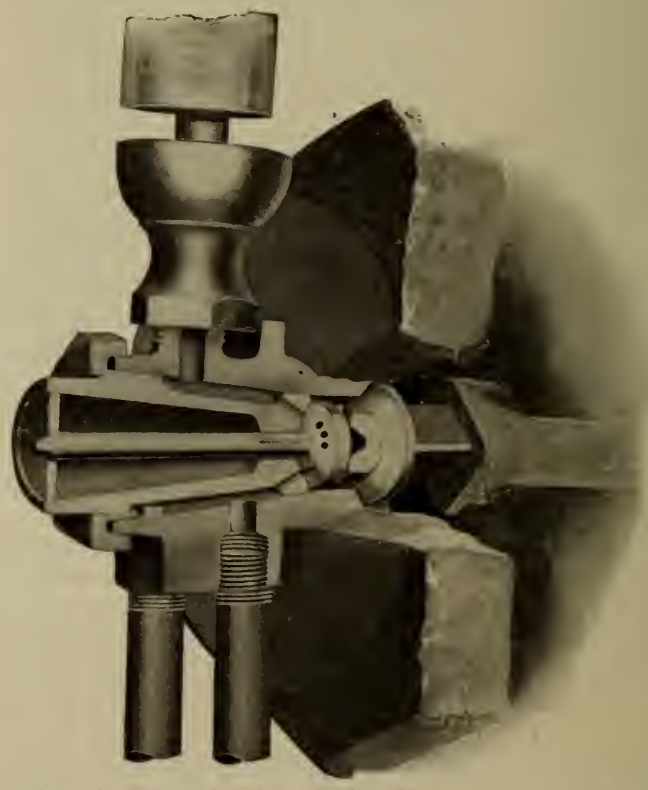


Fig. 3.—Cross Section of Pilot Valve of Berry Regulator.

high or low water. By turning the pilot valve G slightly to the right or left, these operations are advanced or retarded and the water level thereby altered.

With the ordinary instalation, where a number of boilers are fed from the same pump, a feed-valve is placed in the individual feed line to each boiler, and closed by the operation of the regulator when the water rises above the desired level.

In single-boiler instalations, regulation can be obtained with a pump governor in the steam line to the pump; or if a belted pump is used, the control valve can be placed in a by-pass from the delivery pipe to the suction, allowing the pump to run continuously; or a belt-shifting device can be operated to start and stop the pump. This is often accomplished at a great distance, the action being immediate in all cases, as the pipes are full of water.

While primarily intended for use with steam boilers, they have been installed to regulate the water level in hydraulic pressure reservoirs.

Piler & McKenzie, Montreal, are Canadian agents.

---

## THE LINCOLN VARIABLE-SPEED MOTOR.

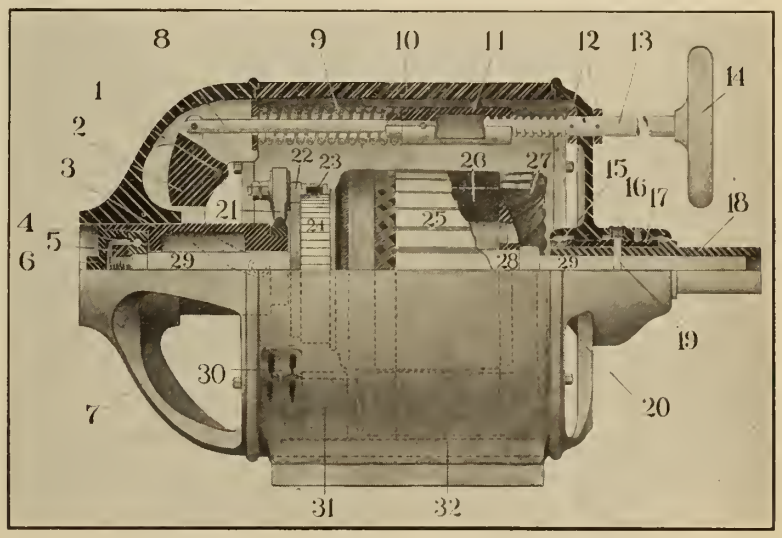
The accompanying illustration is a cross section of a variable-speed motor, in which the speed is varied by a variation in the strength of the magnetic field in which the armature rotates. In any motor the speed of the armature varies directly as the voltage across the brushes and inversely both as the number of turns of wire in the armature winding and as the strength of the magnetic field within which the armature rotates. The limitations and disadvantages of speed variation by varying the impressed voltage.

The strength of a magnetic field varies directly as the strength of the field coils energizing the iron or steel and inversely as the magnetic reluctance of the magnetic circuit. The magnetic reluctance of a magnetic circuit corresponds to the resistance of an electric circuit. Lines of magnetism traverse air with great difficulty, iron very easily, and steel still more readily. In a motor, the magnetic circuit, or path followed by the lines of magnetism, starts in a field pole, crosses the air-gap to the armature, traverses the armature to the next pole piece, again crosses the air-gap, and returns by the second pole piece and motor frame to its starting point. By far the greatest part of the magnetic reluctance of this entire circuit is at the air-gap, and any change in the length or area of the air-gap produces almost proportionate changes in the strength of the magnetic field within which the armature rotates and consequently in the speed.

In a Lincoln variable-speed motor, both the armature and the inner faces of the pole pieces are given a slight taper. Both represent surfaces of truncated cones, one within the other, with the shaft as axis. Any lateral movement of either parallel with the shaft increases or decreases the distance between the two surfaces corresponding with the air-gap. The normal position of the armature is directly beneath the pole pieces and in this position the air-gap is a minimum. Gradually withdrawing the armature laterally, not only gradually increases the length of the air-gap, but also decreases its area; that is, the area of the air-gap no longer corresponds with the total area of the inner face of each pole piece, but with the decreased area now lapping the armature. Both effects produce a gradual increase in the magnetic reluctance, a gradual decrease in the strength of the magnetic field within which the armature rotates, and a gradual increase in speed. On account of the cone-shaped form of the armature and pole pieces only a slight lateral movement is required to produce wide ranges in speed, even as high as one to ten.

One of the most serious problems met with in the design of this motor was some method of overcoming the strong tendency to spark at the brushes as the armature is withdrawn laterally into regions of weaker field. To meet this difficulty special commutating holes use energizing coils are in series relations to the armature are provided, laterally displaced from the main field poles on the side towards which the armature is withdrawn. A two-fold result is thus accomplished. Not only does the commutator effect, at all time and with all positions of the armature, vary with the load, due to serious relations of the coils, but on account of the lateral displacement of the poles the armature as it is withdrawn into regions of weaker field, comes more and more under the influence of the special commutating poles, giving an increased commutating effect, as the strength of the main field decreases. In both cases the commutating effect produced is in direct proportion to the commutating work to be done. The result of this is sparkless commutation up to 50 per cent. overload when running at any speed.

Referring to the accompanying illustration, it is seen that the armature shaft at the driving end of the motor slides within a revolving sleeve on which a pulley or pinion may be mounted in the usual manner. The shaft is keyseated and slides on a feather key of liberal proportions, this feather key being seated in and pinned to the inner face of the sleeve. The sleeve does not move laterally as the armature is shifted for speed adjustment, but is held in position by a shoulder at one end and a circular nut at the other bearing against the two end faces of the bronze bearing bushing. These shoulders take up very satisfactorily any end thrust imparted to the sleeve by the shifting of the armature.




The Lincoln Variable Speed Motor.

At the commutator end, the armature shaft is supported by a combined radial and thrust ball-bearing completely enclosed and protected from all dirt. The inner race of this bearing is clamped between a shoulder and nut at the end of the armature shaft and the outer race is similarly fastened within the sliding thrust bearing box. The brush rocker arm is mounted on the inner end of this box. It is evident that any lateral movement of the sliding thrust bearing box imparts a similar move-

ment to the armature and that the thrust bearing box, rocker arm, brushes and armature, move in unison.

A forked lever, pivoted between two lugs projecting from the inner face of an arm of the end yoke, engages on each side of the thrust bearing box at the end toward the armature. The outer end of this lever is pinned to a short rod which in turn is securely fastened to one end of the speed adjustment nut. A small shaft, on which a hand wheel is mounted outside the pinion end yoke, passes through an arm of this yoke and engages at its threaded inner end with the speed adjustment nut. This shaft is prevented from moving laterally by collars both inside and outside its bearing in the end yoke. Turning the hand wheel, therefore, imparts lateral movement to the speed adjustment nut, and this, in turn, by means of the rod and lever, imparts a similar movement to the thrust bearing box and armature.

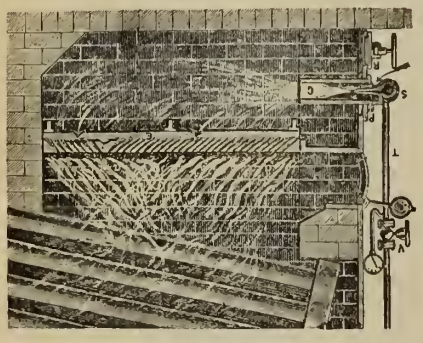
It merely requires a few revolutions of the hand wheel to shift the armature throughout the entire speed range of the motor. This movement of the armature with a slight turn of the hand wheel is hardly perceptible, and it is therefore possible to adjust the speed with any degree of accuracy desired. With the turning of the hand wheel there is a smooth, gradual and continuous change in the speed of the motor throughout its entire range.

This motor is made by the Lincoln Motor Works Co., Caxton Bldg., Cleveland, O.

---

## VENETIAN BLIND GRATES.

In the Poillon's Venetian Blind Grates the bars, instead of being vertical, are inclined in a way very similar to that of the slats in a Venetian blind. The flames are therefore inclined in



Venetian Blind Grates.

their direction and do not impinge perpendicularly upon the boiler plates. The front bars are inclined inwards towards the boilers, while the bars at the back of the grate are inclined outwards towards the furnace door. This causes the flames from the back of the grate to strike against the flames coming from the front, thereby securing a most energetic mixing of the gases and air and consequently a very perfect combustion.

The steam blowers are fitted to the ashpit door directly under the grates so that there is no loss due to long transmission pipes. These blowers are numerous so that no vortices are formed under the ashpit and the combustion is distributed evenly over the whole surface of the grate. The blowers are biconical in shape and designed to obtain the best possible results. The cost of the steam to run them amounts to approximately three and a half per cent. of the whole of the steam given by the boiler.

These grates have been installed in a number of places in the Province of Quebec and have given satisfactory results with anthracite screenings, slacks and other varieties of coal dusts. In the Missisquoi Marble Co., near Montreal, there are two 125-h.p. boilers under which was burnt six tons of bituminous coal at $4.60 per ton every twenty-four hours. A set of Poillon grates was installed and they started burning anthracite bird's eye coal at $2.75 per ton and the daily consumption fell to five tons per day, making a saving of about $4,000.00 a year for the owners.

Besides the saving of coal with Poillon grates, the steam mixed with the blast prevents the bars from burning out and the clinkers from clinging to and deteriorating them. One of the grates was installed in one of Montreal's colleges five years ago and has required only $2.00 expenditure in repairs during that time.

With these grates the residue from gas producers may be burnt. The residue may, therefore, be used for heating the buildings, thus saving considerable expense. By using anthracite screenings and bird's eye coal the combustion is smokeless. Other advantages are also claimed for them. It does away with cold aspiration. Openings in grate are small so that screenings cannot fall through, and screenings at a very low cost may be used.

These grates are being placed on the market by J. de Clercy, C.E., 62 Ontario St. West, Montreal.

---

## NEW SIGHT-FEED LUBRICATOR.

The accompanying illustration is of a new sight-feed steam lubricator which the Penberthy Injector Co., Windsor, are placing on the market, and which contains some features of particular interest. These are as follows:

The gauge glass C, and the filler D, are combined in one, the latter being provided with a vent which enables the cup to be filled quickly and without waste of oil.

The regulating valve K, and drain cock L, are combined in one stem, but are entirely separate so far as operating is concerned, this idea doing away with an extra valve.

The oil gauge C, and the sight feed I, are provided with disc-shaped plate glasses. The chances of these glasses

New Sight Feed Lubricator.

being broken are much less than the old style gauge glasses. These glasses constitute an important feature.

The live steam is always contained in the chamber that passes through the body of oil, thus heating it and making it always feed freely in the coldest weather.

The lubricator is easily connected or disconnected from the engine while the steam is on, which is a great convenience when cleaning or repairing.

---

## WILL STUDY POWER DEVELOPMENT.

The School of Mining, Kingston, has now a course of studies in power development. The increase in the use of machinery has made a greater demand for power, and so great is this demand that the coal mine, waterfall, oil well and peat bog are being utilized. The students in this course will have two options in which they may specialize, hydro-electric work or steam and gas power.

## FUELS OF THE UNITED STATES.*

By Prof. N. W. Lord.

While technically this subject would include not only coal in its various varieties, but gas, oil, wood, peat, and, possibly, other substances, I shall confine what I have to say to coal. Six classes of coal are recognized by the United States Geological Survey: (1) Anthracite, (2) semi-anthracite, (3) semi-bituminous, (4) bituminous, (5) sub-bituminous, or black lignite, and, (6) lignite. I think it safe to say, however, that while this classification is generally useful, it is difficult to draw fast and sharp lines in the classification of a material as variable as coal, in which samples are sure to be found on the border lines of almost any system of classification. The above classification, of course, is only for commercial purposes, and, as such, is generally useful. In a valuable map prepared by M. R. Campbell, and recently published by the United States Geological Survey, the coal areas of the United States are carefully mapped. In this map the coals are grouped (a) as high-grade coals, which include classes 1, 2, 3 and 4, (b) sub-bituminous or black lignite, or class 5, and (c) lignite proper, or class 6. The general qualities of these types of fuel are known and correspond well to the coals of certain regions, as the anthracites of Pennsylvania, the coking bituminous coals of Pennsylvania, the non-coking bituminous coals of Ohio and Illinois. Coals differ widely, not only in their physical characteristics, their behavior under a destructive distilation, some cementing together into a hard coke, or possessing the coking property, as it is termed, others, the so-called dry coals, showing but little or none of this quality, but also in their chemical composition and in their associated impurities.

### Proximate and Ultimate Analyses.

As ordinarily made, the chemical analysis of coal, commonly known as the proximate analysis, is not in the strict sense of the word an analysis at all, but is merely a record of the nature of the decomposition that the coal undergoes when treated in a certain conventional manner. It involves the determination of the moisture under certain specific conditions; of the volatile combustible matter, or the material other than moisture which is driven off by heating the coal in a prescribed way in a platinum crucible; the fixed carbon, which is the loss in weight of the residue after driving out the volatile matter when the combustible matter is all burned out by heating in air; and, finally, the ash or combustible residue left from the foregoing treatment.

As contrasted with this, is the ultimate analysis of the coal in which the actual percentages of carbon, hydrogen, nitrogen, sulphur, oxygen and incombustible residue or ash are determined. This latter method of analysis is strictly a chemical analysis and determines definitely the substances present in the coal.

The heating value of a coal is the amount of heat expressed in British thermal units developed by the complete combustion of one pound of the coal, and for all purposes in which coal is used as a fuel is, of course, the fundamental factor on which the fuel value of the material is based. Table 1 gives the proximate and ultimate analyses and the heating value of a typical coal in each of the foregoing six classes. The following will locate and describe the coals given in the table:

Class 1. Anthracite, culm, Scranton, Penn.

Class 2. Semi-anthracite, Coalhill, Ark.

Class 3. Semi-bituminous, Mora, W. Va.

Class 4. Bituminous coking, near Connellsville, Penn.

Class 5. Bituminous non-coking, Ohio No. 6, Hocking Valley.

Class 6. Sub-bituminous, black lignite, Uinta County, Wyoming.

Class 7. Lignite, Milan County, Texas.

These analyses were, with the exception of No. 5, made upon samples taken from carload lots shipped to the Government fuel-testing plant at St. Louis. The analysis No. 5 is a sample of Hocking coal taken at the time by field agents of the Ohio Geological Survey. It will readily be seen that there is a progressive change, consisting of a decrease in the fixed carbon and increase in the volatile matter, and in the ultimate analysis, an increase in the amount of oxygen and hydrogen. It is interesting to note that the maximum heating value of these coals rests with the semi-bituminous coals of the Pocahontas type, high in fixed carbon and comparatively low in volatile matter. The amount of moisture increases with the type of coal, but only in a very general way. It will be noted that the coals are reported in most cases as air-ried. Coals freshly mined contain considerable water, which is rapidly lost on exposure to air. The analyses are reported upon the coal in approximately the condition of moisture to which it will attain upon standing exposed to the ordinary air, the coal being in a coarsely crushed condition. If the coal be reported as made up of three main constituents: Moisture, the combustible portion or true coal, and, lastly, ash, and the typical analyses of the various groups may be corrected by eliminating by calculation the amount of moisture and ash and restating the composition of the remainder considered as coal. This is done in Table 2.

With the analyses given as in Table 2 the progressive changes in the composition of the material become much more apparent and uniform, particularly the progressive increase in volatile matter and decrease in fixed carbon. Here, again, it will be noted that the heating value of the combustible portion is highest in the semi-bituminous, class 3.

The sulphur in the coal may also be regarded as one of its impurities, though in many cases a considerable portion of it, if not most of it, must be considered as in fact an inherent part of the coal proper, only a portion of it existing as iron pyrites. In many coals, on the contrary, a large percentage of the sulphur

TABLE 1. COMPOSITION OF ILLUSTRATIVE COALS.

| Class. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Proximate Analysis of "Air-dried" Sample.** | | | | | | | |
| Moisture | 2.08 | 1.28 | 0.65 | 0.97 | 7.55 | 8.68 | 9.88 |
| Volume combustion | 7.27 | 12.82 | 18.80 | 29.09 | 34.03 | 41.31 | 36.17 |
| Fixed carbon | 74.32 | 73.69 | 75.92 | 60.85 | 52.57 | 46.49 | 43.65 |
| Ash | 16.33 | 12.21 | 4.63 | 9.09 | 5.85 | 3.52 | 10.30 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| Loss in air drying | 3.40 | 1.10 | 1.10 | 4.20 | Undet. | 11.30 | 23.50 |
| **Ultimate Analysis of Coal Dried at 105° C.** | | | | | | | |
| Hydrogen | 2.63 | 3.63 | 4.54 | 4.57 | 5.06 | 5.31 | 4.47 |
| Carbon | 76.86 | 78.32 | 86.47 | 77.10 | 75.82 | 73.31 | 64.84 |
| Oxygen | 2.27 | 2.25 | 2.68 | 6.67 | 10.47 | 15.72 | 16.52 |
| Nitrogen | 0.82 | 1.41 | 1.08 | 1.58 | 1.50 | 1.21 | 1.30 |
| Sulphur | 0.78 | 2.03 | 0.57 | 0.90 | 0.82 | 0.60 | 1.44 |
| Ash | 16.64 | 12.36 | 4.66 | 9.18 | 6.33 | 3.85 | 11.43 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Calorific Value of "Air-dried" Coal in B.T.U.** | | | | | | | |
| | 12,472 | 13,406 | 15,190 | 13,951 | 12,510 | 11,620 | 10,288 |

*Abstract of a paper read at the third convention of the International Association for the Prevention of Smoke, Cleveland, O., June 24, 25 and 26, 1908.

present is simply mechanically mixed pyrites. It is this uncertainty in regard to the disposition of the sulphur which makes such calculations as are exhibited in the tables only approximate. In these results it should always be remembered that in ultimate analyses of coal the oxygen determined cannot be considered as more than approximately correct, being determined by difference and the results modified by the condition in which the sulphur exists. The foregoing outline serves to show that the coal from any district or mine may be considered as made up of coal proper and a certain amount of mechanically held impurities, consisting of ash, moisture and sulphur in the form of pyrites.

### Variations in Sulphur, Ash and Moisture

One of the results of the investigation of the fuels of the country has been to show that the character of the coal proper is much less subject to variation in the mines of a given seam in a given district than are the relative proportions of the impurities, particularly ash and sulphur, which vary greatly in different portions of the same seam and frequently vary considerably from one portion of a field to the other. A very interesting example of this is found in the Middle Kittanning, or No. 6 coal, of the Ohio series, in which the sulphur in certain portions of the seam covering areas of many square miles in extent will run under 1 per cent., the amount increasing, however, as the seam extends northward until regions are reached where for the same coal the average sulphur content is over 5 per cent.

Variations in the ash take place in the same way, but without so much regularity. Yet throughout the entire extent of this district the variation in the ultimate composition of the actual coal itself is not material. The amount of moisture in coal is a matter of considerable regularity and the power of the fuel to hold moisture seems to be closely connected with its general ultimate composition and nature of the seam. This, of course, refers to the moisture retained by the coal under ordinary conditions of handling. The effects of these impurities upon the quality of the coal are of two general kinds: Those acting as diluents or worthless admixtures reducing, in proportion to the amount, the heating value of the coal of which they form a part.

Sulphur cannot strictly be regarded in this light, as it stands for a heating value of its own equal to approximately half of the coal that it replaces. Moisture, on the contrary, not only reduces the heating value of the coal as a diluent, but absorbs appreciable quantities of heat in its evaporation. Its presence in the coal bears unquestionably a relation of some importance to the nature of the combustion, and probably bears to some extent on the problems of smoke consumption, as it is probable that moisture in the gas of a furnace has a certain power of facilitating the completeness of combustion. In addition to the effect of these materials as diluents, their positively injurious characters must be considered in many operations, as that of sulphur in the manufacture of iron and gas and the clinkering power of ash in obstructing drafts and leading to increased cost and diminished efficiency in the handling of the fuel.

TABLE 2. RESULTS IN TABLE 1 CALCULATED TO ASH AND MOISTURE FREE BASIS.

| Class. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Proximate Analysis.** | | | | | | | |
| Volatile combustion | 8.91 | 14.82 | 19.85 | 32.34 | 39.30 | 47.05 | 45.31 |
| Fixed carbon | 91.09 | 85.18 | 80.15 | 67.66 | 60.70 | 52.95 | 54.69 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Ultimate Analysis.** | | | | | | | |
| Hydrogen | 3.16 | 4.14 | 4.76 | 5.03 | 5.41 | 5.50 | 5.05 |
| Carbon | 92.20 | 89.36 | 90.70 | 84.89 | 80.93 | 76.35 | 73.21 |
| Oxygen | 2.72 | 2.57 | 2.81 | 7.34 | 11.18 | 16.28 | 18.65 |
| Nitrogen | 0.98 | 1.61 | 1.13 | 1.74 | 1.61 | 1.25 | 1.47 |
| Sulphur | 0.94 | 2.32 | 0.60 | 1.00 | 0.87 | 0.62 | 1.62 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| **Calorific Value in B.T.U.** | | | | | | | |
| | 15,281 | 15,496 | 16,744 | 15,512 | 14,446 | 13,203 | 12,880 |

### Geological Survey Tests of Great Importance.

It is difficult to state in dollars and cents the relative importance of these impurities, but under the recent system of coal purchased by the Government, a fairly satisfactory system of figuring coal on analysis with reference to its impurities has been put into successful operation. During the last three or four years the fuel-testing plant of the United States Geological Survey has been accumulating and publishing one of the most extended series of the complete analysis of the fuels of the country that has ever been undertaken anywhere. One point of interest in this work is that the analyses have all been made on large and carefully taken samples representing the average character of the coal shipped from the mine tested, such samples being designated as carload samples and prepared by careful reduction from shipments of coal covering several tons in all cases. The analyses published give illustrative determinations on almost every important coal district in the United States, and, properly used, will enable coal users to arrive at very satisfactory conclusions in regard to the properties of any coal on the market. However, in the use of these analyses the principles outlined in the foregoing discussion must be constantly kept in view. The general character of the combustible portion of the coal from any district may be considered as agreeing quite closely in all samples from the same district, providing the geological designation of the seam is known to be that given by the sample reported in the survey report. The variations shown in samples from the same mine in regard to ash, sulphur and moisture show very clearly that these items can only be judged in a general way as applying to particular samples of the coal, and, therefore, would in no wise diminish the necessity of tests on any particular coal for its ash, moisture and sulphur contents. Similarly, the heating value given will vary with the percentage of impurities, and it will be possible to judge what the average character of the coal from a given district should be, and so set an approximate standard for users of the coal to which shipment of any particular lot may be referred on the determination of the ash, moisture and sulphur.

The use of the ultimate analysis of the coals in figuring up the results of tests on boilers and other efficiency tests can be extended widely by applying the ultimate analyses published in the Government report of similar coals, after making due allowance for the ash, moisture and sulphur considered as the impurities. In most cases calculations of this kind will give results amply accurate for use on ordinary control, when it is necessary to calculate the air required to burn the fuel or similar data of combustion.

Of particular interest to the association for the prevention of smoke is the variations of the different coals in the nature and character of the volatile matter given off on heating. It is well-known that different coals differ in their smoke producing tendencies. Within the last two years a series of important investigations on the destructive distillation of coal has been carried on by Dr. H. C. Porter in the laboratory of the technologic branch of the United States

Geological Survey, in which it has been shown that coals differ very considerably in the nature of the volatile products distilled at low temperatures and in the early stages of heating. These differences correspond to different degrees of combustibility in the liberated gases. The work has also shown differences in the rate at which these volatile materials are expelled from different coals and also in the percentage of inert or non-combustible material present in the gases evolved. Time has not permitted the extension of these investigations to more than a few typical coals, but the results so far obtained indicate that the investigations will prove of great value to the engineer in solving the important problems of specializing furnace design to burn, with the greatest advantage and with the least production of smoke, particular types and classes of coals. The results will probably also be valuable in the important study of the details of methods of firing and handling the coals with reference to the nature and combustibility of the volatile material.

---

## WHAT WAS AT THE EXHIBITION.

As is usually the case, there was a good display of power machinery and engineers' supplies at the Canadian National Exhibition, held at Toronto the first two weeks in September. This year there were many more exhibits of electric motors and engine and power plant supplies than last. One firm showed a producer gas plant and engine in operation, while another exhibited one. There was much that was new and interesting.

The Canadian Weber Gas Engine Co., Limited, Jones Building, Toronto, showed one of their gas plants and engines in operation in the Process Building. The engine was the two-cylinder vertical Weber engine. This firm has been recently organized to manufacture and sell the Weber gas plants and engines in Canada.

Something altogether new in Canada is the commutator grinding machine, exhibited by Langdon-Davies Motors (Canada), Limited, 15 Alice St., Toronto. This is a machine for grinding commutators instead of turning them up. This firm also exhibited electric motors and generators.

Something novel in electric motors in the multi-speed machine shown by the Canadian Electrical & Motor Co., 468-474 King St. west, Toronto. In this motor the speed is changed, not by means of a rheostat, but by means of a lever which operates to change the width of the air gap between the poles and the commutator. This is one of W. A. Johnson's patents.

J. F. B. Vandaleur, 3 Dineen Building, Toronto, has a fine exhibit of electrical instruments and power machinery, most of which is quite new in Canada, and his exhibit gave a good idea of what English manufacturers of this line of goods were doing. Mr. Vandeleur is Canadian representative of quite a number of English firms making power and electrical machinery and supplies.

The James Morrison Brass Mfg. Co., Toronto, made their usual fine exhibit of engineers' supplies. The Smart-Turner Machine Co., Hamilton, made an attractive exhibit of their pumps. The Toronto & Hamilton Electric Co., Hamilton, were represented as usual with quite a full line of their motors and generators.

Harpell-Stokes, Limited, 155 King St. west, Toronto, made an exhibit of electrical motors made by The Ideal Electric & Mfg. Co., Mansfield, O., and a single phase motor made by Century Electric Co., St. Louis, U.S.A., for which firms they are Canadian agents.

The Chapman Double Ball-Bearing Co., Toronto, occupied their usual space in Machinery Hall, where the merit of the double ball-bearing was fully explained. Jones & Moore Electric Co. occupied their usual prominent position with an exhibit of their electrical machinery.

The Dodge Mfg. Co. exhibited a complete line of transmission machinery and appliances, including their wood-split pulley. The Dominion Belting Co., Hamilton, showed their Maple Leaf Belting. D. K. McLaren, Limited., Montreal, had an exhibit of their belting and their waterproof cement.

The Canada Metal Co., Toronto, had their usual fine exhibit of babbit and other metals. Canadian Bearings, Limited, Hamilton, showed Whight's taper-roller bearings in their usual space. The Philip Carey Co., 112 Bay St., Toronto, had a most complete exhibit of pipe coverings, roofing material and similar supplies.

The Economical Mfg. & Supply Co., 173 Queen St. east, Toronto, showed quite a complete line of packing and "Canada Graphite." They also exhibited the "Komo" steam trap, something new on the market, made by "Komo" Steam Trap Co., 40 Rathnally Ave., Toronto. F. Reddaway & Co., 56 St. Francois Xavier, Montreal, exhibited their "Camel" brand hair belting and their linen hose.

The Standard Engineering Co., 43 Scott St., Toronto, made an exhibit of their automatic boiler feed regulator, of which there is a complete description in another part of this issue. The Canadian Steam Boiler Equipment Co. Limited, Toronto, exhibited their cyclone shaking and dumping grate bar.

H. W. Johns-Manville Co., Limited, 85-87 Wellington St. west, Toronto, made a very attractive display of asbestos, both in its raw state and in its many manufactured forms. They also exhibited packing, etc. A. H. Wright, 32 Church St., Toronto, agent for Dudbridge gas and oil engines, exhibited an oil engine.

Rice Lewis & Son, Limited, Toronto, made an exhibit of Cook gasolene motors, as well as of machine tools. Goold, Shapley & Muir, Brantford, occupied their regular space with an exhibit of their gas engines etc. The Garlock Packing Co. had an exhibit of packing, etc., and Nash Thermostats, Limited, exhibited with them.

J. N. Tallman & Sons, Hamilton, had a fine exhibit of metals in the Process Building. The Colville Electric Co., Toronto, had an exhibit of dry batteries, motors and electric fixtures. The Queen City Motor & Dynamo Co., Toronto, made an exhibit of motors and dynamos in Machinery Hall.

Canadian Gas Power & Launches Co., Toronto, had a large exhibit of stationary and marine engines, and also showed a producer gas plant and two large producer gas engines.

The rotary engine is beginning to make itself felt. The Roturo Engine Co., Thorold, Ont., showed their rotary engine, which was exhibited two years ago, but which has since undergone several improvements.

The Gilson Mfg. Co., Guelph, made an exhibit in Machinery Hall of their "Goes Like Sixty" gasolene engines.

The display of electric fixtures, Nernst lamps and small motors, made by the Canadian Westinghouse Co., Hamilton, was most attractive.

---

Some people educate their heads and others educate their feet. It all depends on whether you want to be useful or social.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto, Business Manager.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg., Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

**UNITED STATES**
CHICAGO - J. Purkis Sharpe
NEW YORK - 344 West 145th St., Phone Audubon 2430, R. B. Huestis

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C., Phone Central 12960, J. Meredith McKim

**FRANCE**
PARIS - Agence Havas, 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

**Vol. 1.** **SEPTEMBER, 1908** **No. 1**

## FROM PUBLISHER TO READER.

At this, our first appearance, a word from the publishers to the readers, and to the readers that are to be, is needed. We wish you to realize that we need your co-operation, and that we will be glad to make it worth your while.

There are many ways in which you can give us your support. In every power plant, every month, difficulties are solved. If any one engineer could be present in all these power houses on all such occasions he could make himself a very valuable man,—if he observed. But no engineer can do this. If, however, the engineer in charge of each one of those power houses would write us, our readers could do the next best thing,—read about the overcoming of these difficulties. Therefore, one of the best ways in which you can assist is to write practical articles for us. We will gladly pay for such.

Wholesome criticism is the best treatment a paper can get. If you think anything could be improved, don't hesitate to tell us. You pay for your paper. You have a right to tell us what you want.

Two heads are always better than one. There's nothing like discussion to bring out all the points. We want you to use our columns to carry on discussions. If at any time your views do not correspond to those expressed in these columns, let us have them. You will probably be helping some fellow engineer over a troublesome point.

In such ways can you do your part in the building up of a good Canadian power paper.

A glance over this issue will give an idea of the kind of material we will publish—an idea, because subsequent issues will be much better because of the assistance we will get from our readers.

Anything which will be of value to the man interested in the generation, transmission and application of power in any form, will be published. It's a broad field, yet not too broad when we come to set the boundaries.

Every manufacturer is vitally interested in power, chiefly from a cost-per-horse-power basis. We hope to make the paper valuable to him. For the engineer, whether he be in charge of a 100,000 h.p. hydro-electric plant, a 50,000 h.p. steam-electric plant, or whether he be running a 35 h.p. steam or gas engine, we hope to publish every month something that will help him in his work. For the fireman we will have something to help him keep steam up, and yet not get the city council after him for smoke nuisance.

The convention of the Canadian Association of Stationary Engineers was held in Windsor recently. This issue contains a full report, with photographs of the delegates, of the new officers, and of the supply men. It will be the policy of this paper to publish every year a full report of this and similar conventions, so that any of our readers who are not at the convention will know all that has been done very shortly after the convention closes.

The articles, "Consideration of Air Leakage in Steam Condensers," and "Economy in Air Compression: Methods of Accomplishing it," are samples of the type of the technical articles which we will publish. Such articles will cover steam, gas, electric, hydro-electric and compressed air power.

The article on the fuels of the United States is one of great interest to all power users. Such articles, dealing with the big and radical problems of power development, will receive special attention, and with such we hope to interest every manufacturer. The power problem which confronts every manufacturer of Ontario at the present time, we hope to take up in an early issue, and if possible throw some light into the dark corners. Since the appointment of the Hydro-Electric Power Commission there have been many things happen and much done. If all the facts regarding these were gathered together and condensed, manufacturers and others interested would, no doubt, find the data useful and instructive.

In this issue there are two articles descriptive of recent and up-to-date power plant instalations. Such articles will be a feature of the paper. Manufacturers and engineers will thus be able to keep in touch with all the up-to-date and new methods of power plant equipment and lay out.

To the department, "Practical Articles by our Readers," we wish specially to call the attention of every engineer. In this department is where we wish your assistance, and this is your part, of which we spoke at length above.

The department of new power house machinery and appliances is an important one. Here we will publish descriptions of what is really new and interesting. No engineer can afford to neglect keeping up to date in this respect.

## CAMPAIGN FOR UNIFORM BOILER INSPECTION

Some time ago—more than a year—the matter of obtaining legislation throughout Canada for the uniform inspection of steam boilers, was taken up by the Engine and Boiler Section of the Canadian Manufacturers' Association. A committee was appointed, consisting of Joseph Fux, Brantford; A. W. Spotton, Goldie & McCulloch Co., Galt; F. Raney, John Inglis Sons' Co., Toronto, and G. H. Todd, Polson's Iron Works. This committee has done its work under Frank E. Leonard, Chairman of the Engine and Boiler Section of the C.M.A.

The situation at present is that each Province has its own boiler inspection regulations, each differing from the other. This is extremely inconvenient for manufacturers who sell boilers in all the Provinces. How the boiler is made depends upon the Province in which it is to be used; and the necessary formalities to be gone through also depend upon that. Manufacturers cannot stock boilers to advantage, unless a separate stock for each Province, for which there is not the market. It gives the manufacturer who manufactures only for his own Province an advantage.

This applies only to land and stationary boilers, and not to marine boilers, as there is a Dominion Government Marine Boiler Law which governs all over Canada the manufacture and use of Marine boilers.

In April last this committee made its first report, a draft of which was sent by the C.M.A. to all boiler manufacturers and dealers, asking for suggestions and criticisms. A number were received, and the committee drew up a second report in which these suggestions and criticisms were considered. This report has been sent by the C.M.A. to those interested, not many days ago. This matter will come up for discussion at the meeting of the Engine and Boiler Section of the C.M.A., at the convention in Montreal, September 14 to 18, and it is hoped that all will come prepared to take a strong stand on the question. A campaign for bringing about this desired end will be arranged at the meeting.

Some opposition is looked for from the Provincial Governments and probably from the manufacturers, few in number, who sell only in their own Provinces, and thus have an advantage in the present system. Opposition may also come from some of the officials connected with boiler inspection in the several Provinces, who may imagine their positions jeopardised by such legislation.

That a measure providing for uniform boiler inspection will be for the ultimate good of all manufacturers and users of steam boilers, there is little doubt. No small consideration should stand in the way of this being brought about. When the Dominion Government is approached a thorough investigation should be made and steps be taken to enact legislation to accomplish the desired end. Concerted action on the part of boiler manufacturers and dealers interested would materially strengthen the C.M.A. in the campaign. We hope to see this thing go through. The Dominion Government should see the necessity of it, and should see that there are no unnecessary delays.

## NEW MACHINERY HALL NEEDED.

Exhibits of machinery and supplies for the power plant at the Canadian National Exhibition this year were quite representative and interesting. There was much shown that had real educative value. The effect of these exhibits was, however, much depreciated by the fact that they were scattered over two buildings, instead of being all together, as they should be. This points, as many other conditions point, to the necessity of having a new machinery hall in which there could be sections for the different classes of machinery. A building such as this could be made really educative, and a more interested crowd of people attracted to it. An exhibitor rather hates to spend his good money in making an exhibit and then to talk himself hoarse to person after person, only one in twenty-five or one in one hundred of which is directly or indirectly interested in what he has to talk about.

For several years the MacLean Publishing Co. have pointed out this necessity of a new machinery hall. We are glad to see that the manufacturers are now taking a strong stand in urging the Exhibition directors to provide a new machinery hall. At the directors' luncheon on Manufacturers' Day this matter was the theme of most of the manufacturers' addresses. The speeches were all short and to the point, and the point was, in most cases, the necessity for a new machinery hall.

Technical education is receiving much attention just now. The city of Toronto, the Provincial Government and the Dominion Government are all considering large expenditures in this direction. The building of a new machinery hall and the attracting of a lot of high-class and educative exhibits would be a great means of promoting technical education.

Surely the Exhibition directors will see the value of such a step taken immediately, to the great number of people in Canada who are engaged in the practical end of manufacturing, and through them to the Exhibition

We fully expect that before the opening of the Exhibition a year from now a fine new machinery hall will be in existence, equipped with cranes and railway sidings necessary for the handling of heavy machinery.

## MANUFACTURERS AND THE C.A.S.E.

That the aims of the Canadian Association of Stationary Engineers are such as to ensure the success of this organization are quite apparent to one attending their conventions. The nineteenth annual convention, held at Windsor recently, was regarded as the most successful in the history of the organization. At this convention the association had a great deal to look back upon as well accomplished, and still more to look forward to as yet to be done. Their campaign to interest the Government in examinations and certificates for engineers is now bearing good fruit. This is a worthy work for such an organization. What has been accomplished means much to engineers, and it also means much to manufacturers. All employers of engineers owe a debt of gratitude to the association for their work along this line.

The aims of this association are educational in nature. They realize that it is through education that the status of engineers can be raised. In this work all manufacturers and employers should take an active interest.

Two years ago there was an exhibitors' association formed, and through this association there are great possibilities for educational work. Everything new or interesting which is being placed on the market by manufacturers and supply men could be exhibited. This association should receive the hearty support and co-operation of all manufacturers and supply men selling to the engineer. It is only in this way that a real good exhibit can be made.

# Electric Locomotives Now in Use in St. Clair Tunnel

## Important Feature of G.T.R.'s New Route from East to West of Canada via Chicago—Description of Locomotive and Power House Equipmentr

Powerful electric locomotives have replaced the mighty steam moguls used to handle trains through the St. Clair tunnel. With this new system there is no smoke, no noise, no jarring and a high speed can be obtained by the electrical locomotives if necessary. It is expected that this installation, overcoming quite an engineering problem, will save thousands of dollars every year to the company, and will greatly facilitate the handling of fast freight. The electric locomotive that hauled the first passenger train through the tunnel took back on its return a thousand tons of freight. To have hauled that amount under the old system would have required two steam locomotives, and they would not have accomplished it as quickly.

Fig. 1—Electric Locomotives in St. Clair Tunnel of G.T.R.

The electrification of the St. Clair tunnel is one of the most important works which the Grand Trunk has undertaken. It means much greater safety; and the greater facility in handling trains will enable the Grand Trunk to cut into the traffic that has hitherto gone by the United States routes. The cost entailed by the installation of the electric system is about $500,000, but the car handling capacity of the tunnel has been increased and the danger by asphyxiation of men working on the trains has been removed.

The complete locomotive consists of two half units, each half unit containing three pairs of driving wheels. To each pair of driving wheels is geared a 250 h.p. single phase alternating current motor. The frame of the locomotive is built along the same general lines as is common for steam locomotives, the exact type of course being changed to conform to the requirements of the electric locomotive. In the frame is installed a locomotive cab, which is built up of structural steel frame work, on which is mounted the sheet steel top and sides. It is of uniform cross-section throughout, provided with doors at each end, one door on each side. The end doors provide for direct passage from one half-unit to another, when they are coupled together for operation as a single unit. The couplers, bumpers, foot-boards, air couplings, etc., are of the standard type used in the Grand Trunk Railway system.

Inside the cab is installed most of the electrical equipment necessary in connection with the operation of the locomotives. Practically all of the operations necessary in connection with the running of the locomotives are controlled directly or indirectly by the pantograph trolley seen on the top of the locomotive. This device folds at the joints in such a way as to give a large range in the elevation of the contact bow, this varying from about 22 feet above the top of the rail in the yards to about 17 feet above the top of the rail when the locomotive passes through the tunnel. The pantograph trolley bow is held against the trolley wire by means of a spring, tending to raise the trolley bow. The trolley is lowered by means of an air piston, whose operations are controlled by means of an electric push button.

The current from the trolley passes next through the necessary circuit breakers, instruments and central switches to a transformer, in which the voltage is reduced from 3,000 to about 250 volts. From the transformer the current passes through additional controlling switches to the motors installed alongside the driving wheel axles under the locomotive cab. In order to provide a larger overload capacity for both transformers and motors, an electrically driven blower is installed in the locomotive cab, which furnishes a sufficient supply of cooling air for both transformers and motors. A motor driven air compressor is also installed in the cab and supplies compressed air not only for the operation of the brakes on the engine and the train service, but as well for the operation of the various devices on the locomotive for which compressed air is used, including the operation of the pantograph trolley bow, the operation of the electrically controlled switches, the ringing of the bell, the sanding of the track, the setting of the circuit breakers, etc. All of these operations are under the immediate control of the locomotive driver. The control of the locomotive is through a lever that is operated in a manner very similar to that in which the throttle is controlled on a steam engine. The operation of this lever closes electric circuits which operate by means of magnets on the air valves, which in turn operate the electrical switches used in controlling the supply of energy to the locomotive. The air brake equipment is installed in immediate proximity to the master controller lever used for operating the locomotive.

A series of push buttons are installed on the top of the controller and are used for controlling certain functions, such as the setting of the circuit breakers, the raising and lowering of the pantograph trolley bow, etc. Foot push buttons or pedals are installed for controlling the ringing of the bell and the application of the air sanders to the tracks. For supplying the auxiliary current used in the operation of the electrically controlled switches, a small storage battery is installed in the cab, and this battery is charged by means of a small generator

set operated from the secondary of the main transformer installed in the locomotive. The complete set of indicating instruments,such as ammeters, voltmeters and wattmeters, are installed in the locomotive and give the engine driver full information at all times with regard to the operation of the locomotive. The locomotives are provided with standard locomotive bells, whistles and special electrical headlights.

All the weight of the locomotive rests upon the driving wheels, thus bringing into effective use and tractive effort, every pound of its weight. The electric locomotive has this advantage over the ordinary locomotive, in which the dead weight of the tender, and very often, all that part of the locomotive that is carried on the small truck wheels, is of no value in pulling the train, only that part of the weight that is located on the driving wheels being effective in this respect. The illustration shows one of these powerful electric locomotives coming out of the tunnel. The locomotives are the Westinghouse type.

Six locomotives complete the equipment. The weight of each is between 60 and 65 tons, and one locomotive will develop a normal draw-bar pull of about 50,000 pounds. The tunnel itself is slightly over 6,000 feet long and the total length of the electrification is about 20,000 feet. The track through the tunnel is a single one with double track approaches. The power house is located on the Port Huron (Mich.) side, and is equipped with two 1,250 k.w., 3,300 volt, 25 cycle Westinghouse-Parson's turbo-generator units, together with the necessary exciters and complete switchboards. A battery of 600 h.p. B. & W. boilers with superheaters and condensers furnish steam. The overhead system of transmitting power is in use and wires are strung through the tunnel. The St. Clair Tunnel equipment is an extremely interesting one and a real advance in engineering.

---

## TYPES OF ENGINEERS.

By Geo. Rice.

There are several types of engineers. It is interesting to observe some of the characteristics of these different classes of engineers. There are careless engineers, excessively economical engineers, wasteful engineers, conservative engineers, drinking engineers, dude engineers, slouchy engineers, experienced and inexperienced engineers, and girl engineers. The superintendent or proprietor of a plant certainly has his hands filled when he undertakes to engage an engineer. Since engineers have had to be licensed the matter is somewhat easier, and good men who have been examined, tried and passed can be hired. Still, there are many men who develop traits after they have been passed by the examining boards. Some men seem to lose ground. They fall off. They may have been experts and active, but as

The Dude Engineer.

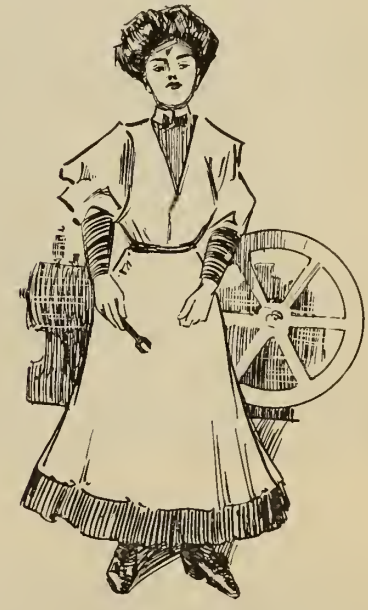
time passed and they got to drinking and loafing, they became quite worthless. The engine room is a place where the has-been can find no room, except that it be in a country shop where the engineer is a roustabout who does all of the tinkering and general mechanical work of the establishment. We live in an age when live, experienced, tried and

The Careless Engineer.

capable men are needed in the engine room. Men who have had technical education are no longer laughed at. In fact, there are cases in which the young men have been placed in charge of the power plants of important places solely on the basis of technical instruction in an engineering school.

The records show that some of these men have failed, and trained engineers under them have been obliged to jump in on the moment to set things right. Still, the majority of the technically educated men prove effective.

I suppose that in hiring an engineer the employer seeks to find first of all something concerning the habits of the applicant. Drunken men are not wanted. It may be all right to work in a man who drinks in the working departments at the benches, for he will not endanger lives, and perhaps his spree is only a day or so each monthly pay day. But the drinking engineer has to be avoided, for fear that he may do something desperate when under the influence



The Girl Engineer.

of liquor, even though the occasion be infrequent. The drunken engineer does not stand much of a chance to get good openings in first-class plants. He has to take what he can get.

The careless engineer is soon found out. The fact that he is careless may not be a black mark on his record and he may carry with him a good discharge paper from the last employer, but as soon as the careless engineer gets to work and meets with endless troubles the employer is on to him. If through the carelessness of the engineer the works are shut down occasionally to pack a cylinder head, to lace a big belt, or stop a leak somewhere, when these things might be done during the noon-hour stop or at night, the engineer loses in favor and the employer may be on the lookout for another man. The employer does not take kindly to the engineer who, through carelessness, almost brings on an accident. Not long since, one

man put a ladder up on the greasy engine room floor. He went up to the shaft journal overhead to adjust a defective set-screw. The bottom of the ladder slid on the oiled floor, and the engineer toppled over squarely on the speedy belt of the engine fly wheel. Luckily for the engineer the belt pushed him forward and gave him a hard bump on the floor to one side.

Then there is the dude engineer, a character which has come into existence the past few years. The owners of steam plants like to see their employes well and neatly dressed when off duty. It is a compliment to the works to have the workers looking well and contented. But often there are engineers and firemen who carry the fine dress problem to excess. I met with one man in an engine room with practically an evening dress—white shirt front and plug hat. I wondered how it could be. I noticed that he went to a closet nearby and unlocked the door. Here he carefully placed away his tall hat and clothes and in a few minutes was in overalls and ready for work. Of course we have to allow for notions on the part of all men. I saw one engineer who came to the mill in an automobile. This seemed to be odd. The thought came to me that the engineer must be a sport and lucky at the races. Later I discovered that his son was agent for an automobile concern and was accustomed to take his "pa" to and from works every day.

One must expect to find some very odd characters in the general run of engineers. I will not forget the funny-looking engineer I saw in a western power station. This man could have made a hit on the stage. He was not only odd in facial expression, but he was dressed queerly for an engineer. He wore an old, oversized, fur-covered-like plug hat. He had on a black coat and white canvas trousers. He wore a linen collar and had a pipe in his mouth, although there was a sign up, "No smoking."

But I was told that this man performed his duty well. Proprietors will put up with a great deal from a good man. By a good man they mean a steady man who keeps his apparatus in good working order, who is not always kicking about something, and who goes to work and acts when necessary. Such an engineer may have odd traits in his character, all of which are overlooked.

Then there is the girl engineer. She is a new character. The women are working into the various professions slowly but surely. The woman engineer does not undertake to manage anything very extensive or complicated, I found only three women engineers in four years traveling in many parts of the country. One was the engineer in a laundry, where the little engine was operated by gasoline. Another was an engineer in a candy shop, where she could chew gum and eat taffy to her heart's content. The other ran the engine for her dad in a shingle mill, which the enterprising farmer had put up on his land in order to make some of the lumber marketable. These girls did their work well, so far as could be seen.—Practical Engineer.

---

# Power Plant of Colonial Portland Cement Co.

## A Fine Power Plant—Individual Motor Drive and Automatic Oiling System—Illustrations and Description of Plant.

A fine power plant is that of the Colonial Portland Cement Company, Wiarton, Ont., and one in which there is an excellent exhibition of the application of individual motor drive. It is quite evident that the plant has been laid out with great care. The accompanying illustrations gives some idea of the building and equipment. Fig 1 is an exterior view of the plant. Fig. 2 is an interior view of the power house, showing the construction of the building and the arrangement of the units. Fig. 3 is a close view of one of the generators. Fig. 4 is an interior view of the cement plant.

The boiler equipment in the plant consists of four water tube Sterling boilers, 396 h.p. each, made by the Sterling pounds. The boilers are equipped with two single acting "Marsh" feed pumps, made by The American Pump Company, Battle Creek, Mich. The engine equipment consists of three cross compound condensing Corliss engines, 16 x 32 x 36, made by The John Inglis Sons Co., Toronto. The condenser equipment and pumps were also supplied by this firm. Two of these engines are direct connected to 320 k.w., 3 phase, 60 cycle, 550 volt generators, built by the General Electric Co., of Sweden, and supplied through their Canadian agents, Kilmer & Pullen, Toronto. The speed is 100 R.P.M. The commercial efficiency of these generators at full load is 93.8 per cent. The power factor is 0.85 The third engine is connected by means of rope drive (American style) to a line shaft from which the Griffin dry grinding mills are operated. Speed 9.0 R.P.M.

The engine room is equipped with an automatic oiling system from an elevated tank in the engine room.

The switchboard is a regular three panel board, one for each machine and one distributing board.

Individual motor drive is adopted throughout the plant. All these motors are squirrel cage type induction motors, 500 volt, 60 cycle, slow speed, also supplied by Kilmer & Pullen, Toronto, and made by the General Electric Company, of Sweden. Each of these motors is equipped with auto-starter and fuses.

Fig. 1—Colonial Portland Cement Co.'s Plant, Exterior View.

There are four main circuits from which all these motors are fed. From the switchboard to the mains in the kiln building are lead two, 3-core, 350, 000 C.M. lead covered underground cables. Circuit No. 1 supplies one 6 h.p. motor for conveyors, one 55 h.p. motor for crushing rolls, elevators and belt conveyors, one 8 h.p. to fans, two 12 h.p. to coal elevators, one 75 h.p. to

coal grinding room, and one 12 h.p. to coal dryer.

Circuit No. 2 supplies power to four 20 h.p. motors direct connected to speed regulators, which in turn drive the kilns proper, and to one 12 h.p. operation agitation in spillway and slurry pumps.

Circuit No. 3 supplies two 55 h.p. direct connected motors to two mills for grinding slurry, one 12 h.p. motors operating three 8 x 24 duplex slurry pumps, and one 9 h.p. motor agitating in slurry pit under the mill.

Circuit No. 4 supplies one 55 h.p. motor belled to shaft operating shale dryer, shale pulveriser, elevator and conveyor, two 16 h.p. direct connected to mixing mills, four, 20 h.p., operating two stone separators, one 9 h.p. agitating in rough slurry pit, and one 12 h.p. direct connected to an 8 x 24 duplex slurry pump.

This plant has been in operation just one year now, although the installation had been made some time before. But owing to unexpected delays the engines and generators were turned over just a year ago.

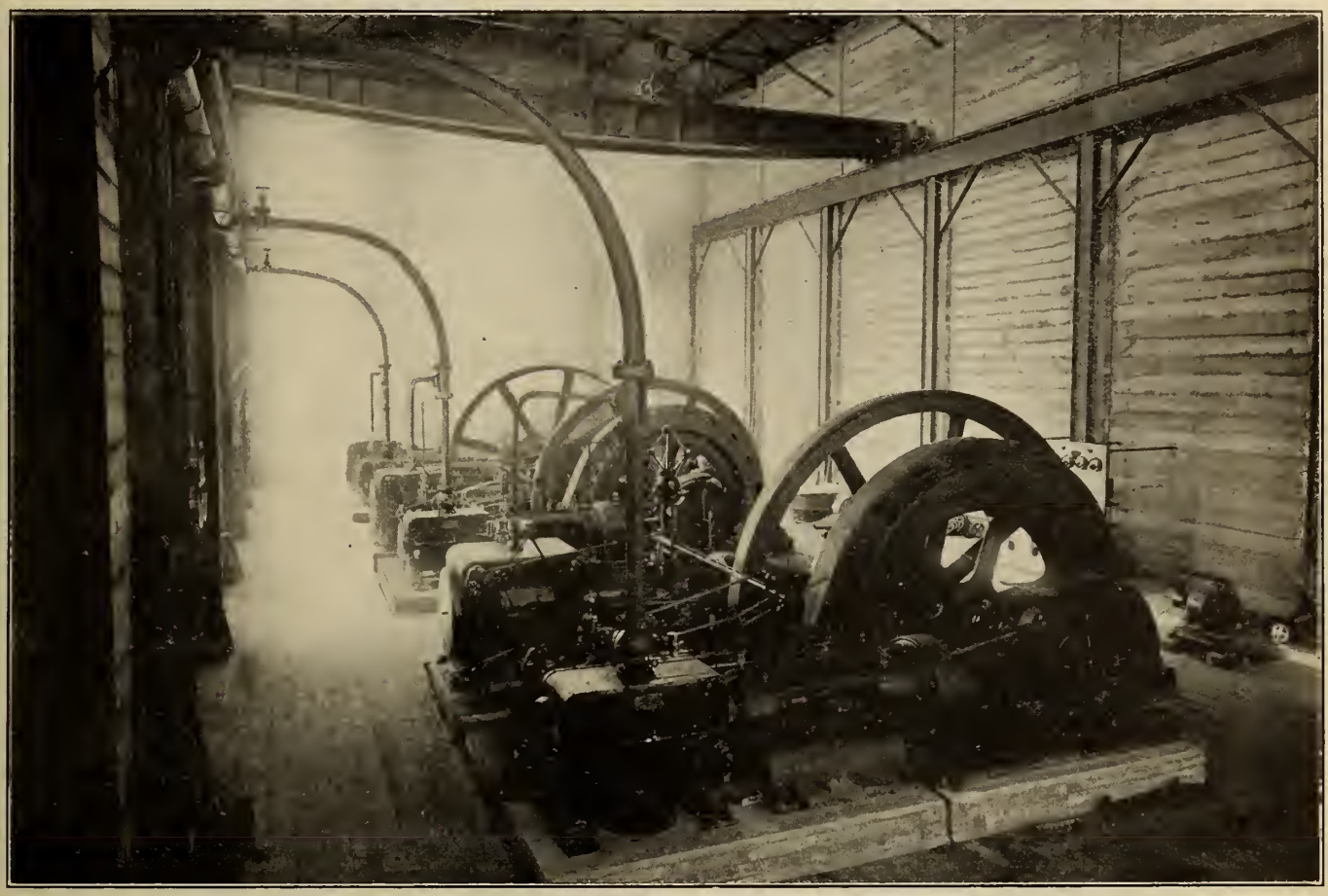


Fig. 2—Interior View of Power House, Showing Construction of Building.

Fig. 3—Near View of Generator.

Fig. 4—Interior of Cement Plant.

The world needs justice more than philanthropy.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non advertisers.**

### Gas Producer Plants.
W. H. Oliver & Co., Toronto.
Canadian Fairbanks Co., Montreal
Gas & Electric Power Co., Toronto.

### Motors.
Packard Electric Co., St. Catharines.
Kilmer & Pullen, Toronto.
Gas & Electric Power Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Generators.
Packard Electric Co., St. Catharines.
Kilmer & Pullen, Toronto.
Gas & Electric Power Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee.

### Venetian Grates.
J. De Clercy, Montreal.

### Turbine Water Wheels.
J. C. Wilson & Co., Gleaora, Ont.

### Exhaust Heads.
Standard Engineering Co., Toronto.

### Steam and Oil Separators.
Standard Engineering Co., Toronto.

### Planimeters.
Jas. L. Robertson & Sons, New York.

### Gravity Closing Ventilators.
Standard Eagineering Co., Toronto.

### Boilers.
Waterous Eagiae Works Company, Brantford.
Goldie & McCulloch Co., Galt.

### Boilers, Marine.
Waterous Engine Works Company, Brantford.
Goldie & McCulloch Co., Galt.

### Boilers, Horizontal Tubular.
Waterous Engine Works Company, Brantford.
Goldie & McCulloch Co., Galt.

### Boilers, Vertical.
Waterous Engine Works Company, Brantford.
Goldie & McCulloch Co., Galt.

### Boiler Feed Regulators.
Staadard Engineering Co., Toronto.

### Pump Governors.
Standard Engineering Co., Toronto.

### Boiler Mountings.
Staadard Engineering Co., Toronto.

### Steam Traps.
Staadard Engineering Co., Toronto.
Sheldons Limited, Galt.

### Steam Pumps.
Goldie & McCulloch Co., Galt.

### Power Pumps.
Goldie & McCulloch Co., Galt.

### Condensers.
Goldie & McCulloch Co., Galt.
Laurie & Lamb, Moatreal.

### Power Transmission Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Company, Brantford.
Dodge Mfg. Co., Toronto.
Canadian Fairbanks Co., Montreal

### Belt Tighteners.
Waterous Engine Works Company, Brantford.

### Hangers.
Waterous Engiae Works Company, Brantford.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt.
Canadian Fairbanks Co., Montreal

### Shafting.
Unioa Drawn Steel Co., Hamilton.
Waterous Engine Works Company, Brantford.
Canadian Fairbanks Co., Montreal
Goldie & McCulloch Co., Galt.

### Belting, Leather.
Canadian Fairbanks Co., Montreal
Sadler & Haworth, Montreal.

### Wood Split Pulleys.
Canadian Fairbanks Co., Montreal
Dodge Mfg. Co., Toronto.

### Engines, High Speed Automatic.
Waterous Engine Works Company, Brantford.

### Engines, Simple and Compound.
Waterous Engiae Works Company, Brantford.

### Engines, Corliss.
Goldie & McCulloch Co., Galt.

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.

### Engines, Gas and Gasoline.
W. H. Oliver & Co., Toronto.
J. De Clercy, C. E., Montreal.
Jones & Glassco, Montreal.
Gas & Electric Power Co., Toronto.

### Engines, Wheelock.
Goldie & McCulloch Co., Galt.

### Steam Specialties.
Peaberthy Injector Co., Windsor.
Jas. Morrison Brass Mfg. Co., Toronto.
Standard Eagiaeering Co., Toronto.
Sheldons Limited, Galt.

### Valves.
Canadian Fairbanks Co., Montreal
Jas. Morrison Brass Mfg. Co., Toronto.

### Feed Water Heaters and Purifiers.
Darling Bros., Montreal.

### Reducing Wheels.
Jas. L. Robertson & Sons, New York.

### Watt Meters.
Gas & Electric Power Co., Toronto.

### Dynamos.
Toronto & Hamilton Electric Co., Hamilton.

### Indicators, Steam Engine.
Jas. L. Robertson & Sons, New York.

### Heating and Ventilating Apparatus.
Sheldons Limited, Galt.

### Injectors.
Penberthy Injector Co., Windsor.
Jas. Morrison Brass Mfg. Co., Toronto.

### Stocks and Dies.
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Switchboards, Light and Power.
Hill Electric Mfg. Co., Moatreal.
Gas & Electric Power Co., Toronto.

### Switches, Electric.
Hill Electric Mfg. Co., Montreal.

### Switchboard Supplies.
Hill Electric Mfg. Co., Montreal.

### Belt Dressings.
Stephenson Mfg. Co., Albany, N.Y.

### Driving Rope—Cotton.
Jones & Glassco, Montreal.

### Boiler Cleaner.
Canada Chemical Mfg. Co., London.

### Electric Light Instalations.
Gas & Electric Power Co., Toronto.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

## ALPHABETICAL INDEX TO ADVERTISERS


**B**
Borden-Canadian Co. ..... 45

**C**
Canadian Fairbanks Co. ..... 6
Curtis & Curtis, The, Co. ..... 46

**D**
Darling Bros. ..... 46
De Clercy, Jules, C.E. ..... 5
Dodge Mfg. Co. ..... 47

**G**
Gas & Electric Power Co. ... inside front cover
Goldie & McCulloch Co. ..... 8

**H**
Hill Electric Co. ..... 5

**J**
Jones & Glassco ..... 7

**K**
Kilmer & Pullen ..... 2

**L**
Laurie Engine & Machine Co., Ltd. ..... 46
Laurie & Lamb ..... 7

**M**
Morrison Brass Mfg. Co., Jas., Ltd.. outside back cover

**O**
Oliver, W. H., & Co. ..... 2
Owen Sound Iron Works ..... 46

**P**
Packard Electric Co., Ltd. ..... 3
Penberthy Injector Co., Ltd....outside front cover
Phillips Electrical Works, Eugene F., Ltd. 46

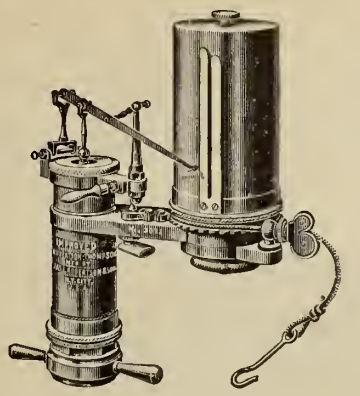
**R**
Robertson, Jas. L., & Sons ..... 45

**S**
Sadler & Haworth ..... 5
Sheldoas Limited ..... 4
Sight Feed Oil Pump Co. ..... 4
Standard Engineering Co. ..... 4
Stephenson Mfg. Co. ..... 7

**T**
Toronto & Hamilton Electric Co. ..... 46
Toronto Plate Glass Importing Co. ..... 5

**U**
Union Drawn Steel Co. ..... 45

**W**
Waterous Engine Works Co. ..... 1
Wilson, J. C., & Co. ..... 5



The
**Robertson-Thompson Indicator**
And
**Victor Reducing Wheel**

are invaluable to every engineer who sees the importance of keeping his engines running at the highest-efficiency, greatest-economy point—all the time.

This outfit is correct in design, principle and construction. Its records are perfect in accuracy and always reliable.

Any engineer can buy this apparatus and hardly notice the expense.

**Moderate in Price**
**Sold on Easy Terms**

THE WILLIS PLANIMETER is the most perfect on the market.

*WRITE FOR DETAILS*

**Jas. L. Robertson & Sons**
**38 Warren St., New York**

**UNION DRAWN STEEL COMPANY,** Limited

*Manufacturers of*

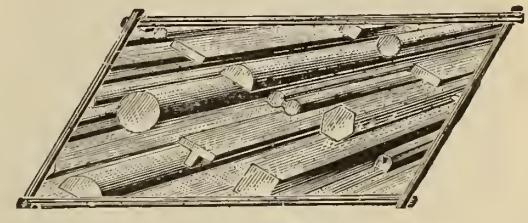
**BRIGHT FINISHED STEEL**

Largest in Canada. Best Equipped on the Continent.
Capacity twice present requirements of the trade.

***Rounds, Flats, Squares and Hexagons***

LARGE STOCK

*Send for Price List*



Office and Works :

***HAMILTON, CANADA***

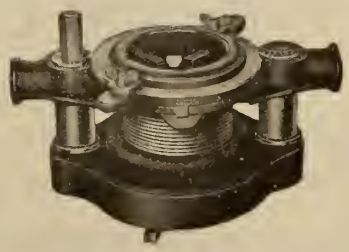
**No Stripped Threads**

when you are threading pipe with

**Beaver Die Stocks**

Rear view showing gears—They are incased.

The dies are automatically released when backing off. You can thread four sizes of pipe on a Beaver Die Stock without changing dies ; and the adjustment from one size to another occupies but a few seconds. We guarantee the Beaver to cut easier and wear longer than any other die stock on the market.



**Free**

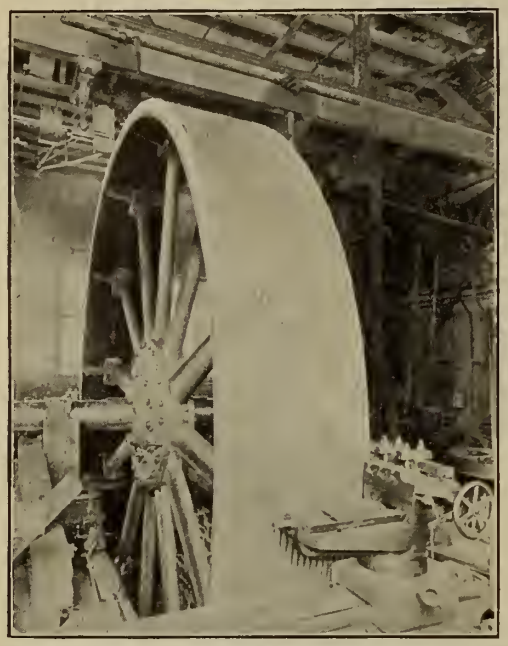
Upon request we will ship you a Beaver Die Stock for ten days' free trial. If it's not what we claim we'll take it back without charging you one cent.

***BORDEN CANADIAN CO.***

*66 Richmond St. East, - TORONTO*

## IRON CASTINGS

ALL SIZES



Rope Pulley, 30 ft. diameter, made at our works for Canada Tin Plate and Sheet Steel Co., Morrisburg.

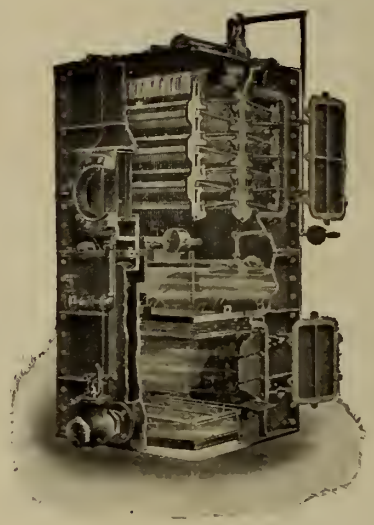
**LAURIE ENGINE AND MACHINE CO., Ltd.**

MONTREAL

## Steam Power Users

Are you permitting condensations and exhaust steam to go to waste? The

**Webster Feed Water Heater**
**Purifier and Filter**



turns waste into profit by utilizing all condensations and exhaust steam. We have been in this business a great many years and have accumulated a vast fund of experience which is at your service.

The 2.000,000 h.p. of Webster Heaters in use to-day is surely the best of recommendations!

Write for Our Booklet!

**DARLING BROTHERS, LIMITED**

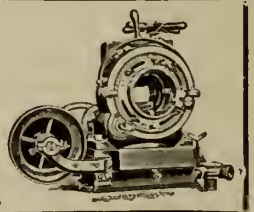
TORONTO MONTREAL WINNIPEG

FRANK DARLING Agent, Vancouver, B.C.

## HAND OR POWER

Pipe Cutting and Threading Machines. The machine we illustrate comes supplied with fittings for power operation; power base, pinion, etc. Taken from its base it can be used as a hand machine. Works in small space.

CATALOG?

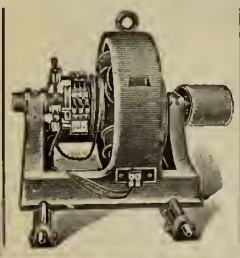


**THE CURTIS & CURTIS CO.,** *36 Garden Street, Bridgeport, Conn., U.S.A.*

**OWEN SOUND IRON WORKS, LIMITED**

*OWEN SOUND, ONT.*

Cement Mill Machinery, Boiler and Steel Tank Work of all kinds, Grey Iron and Brass Castings



## ALTERNATE CURRENT DYNAMOS and MOTORS

*FOR ALL CIRCUITS*

**TORONTO & HAMILTON ELECTRIC CO.**

99-103 McNab Street, HAMILTON, ONT.

# Eugene F. Phillips Electrical Works, Limited

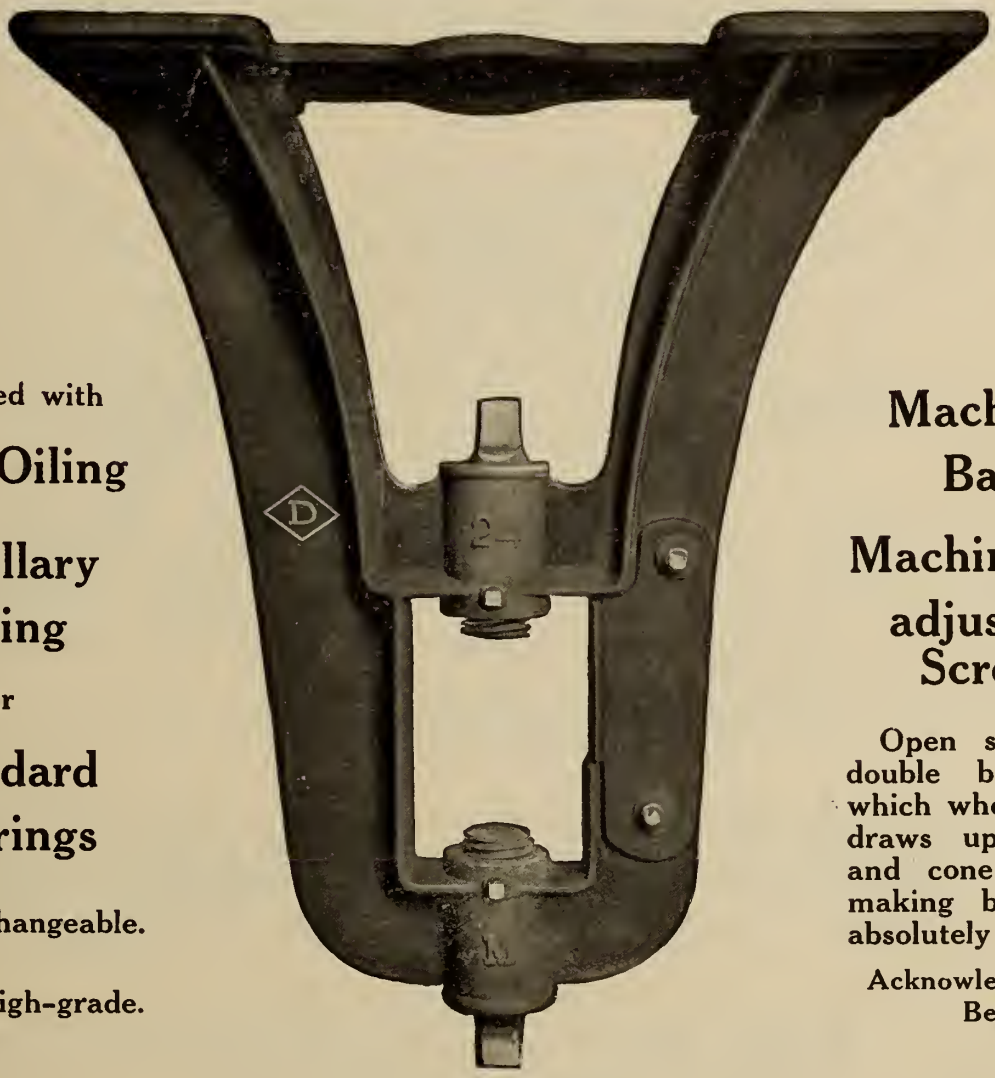
## Montreal, Canada

TORONTO STORE, - - 67 ADELAIDE ST. EAST

# Magnet and Trolley Wire
# Bare Copper Wire, Weatherproof Wire

# THE MODERN HANGER

## Ball and Socket Machine Molded




Supplied with

**Ring Oiling**

**Capillary Oiling**

or

**Standard Bearings**

All interchangeable.

Strictly high-grade.

**Machined Bases**

**Machine cut adjusting Screws**

Open side, with double brace link which when closed, draws up on cup and cone feature, making both sides absolutely rigid.

Acknowledged the Best.

## We carry the largest stocks of Hangers

IN CANADA

All sizes, drops and weights on hand for immediate shipment.

SEND FOR OUR HANGER BOOKLET

# DODGE MANUFACTURING CO.

Toronto Montreal

# ¶ Every Power User, Engineer or Superintendent of a Power Plant

will find in this issue of "THE POWER HOUSE" something of direct interest to them. To make every issue valuable to our readers we propose presenting each month as complete a record of what is going on in the power field and in the power plants of Canada, as enterprise and the best of facilities can obtain.

¶ During the next twelve months over 400 pages of good live power and engineering information will be published. Can you obtain this amount anywhere else for $1.00, the subscription price of "THE POWER HOUSE."

¶ Manufacturers and power users who receive this copy should see that this and every succeeding issue reaches the man in charge of their power plant—it will pay.

¶ Fill out the attached coupon and mail to us with $1.00. Do it TO-DAY!

CUT OFF HERE AND MAIL NOW

**THE MACLEAN PUBLISHING CO. Limited**
**10 Front St. E.**
**TORONTO**

Please mail to address below one copy of "THE POWER HOUSE" for twelve months. Enclosed find one dollar to pay for same.

*Name* .....

*Street No.* .....

*City or Town* .....

*Province* .....

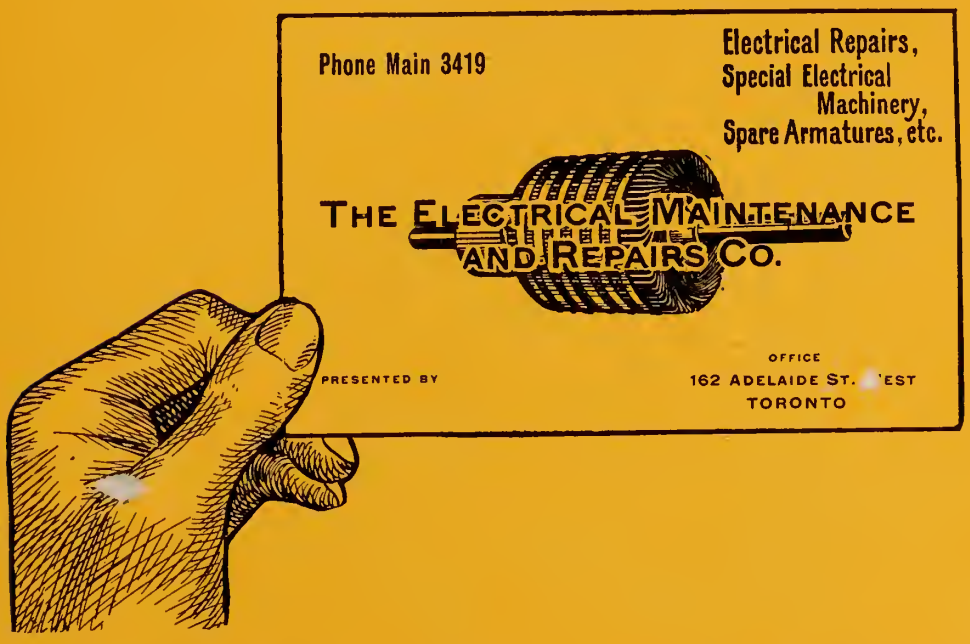
## The Maclean Publishing Co.

**Limited**

**10 Front Street East,**

**TORONTO**

# Good Morning, What can we do for you to-day?




## THE STEAM ENGINE INDICATOR AND ITS APPLIANCES

***BY WM. HOUGHTALING***

This book describes clearly the application and use of the Steam Engine Indicator, with illustrations, rules and examples for obtaining best results in the Economical Operation of Steam, Gas and Ammonia Engines. It gives accurate information on the adjustment of Valves and Valve Motion, Computing Horse-Power of Diagrams, and attaching the Indicator.

**320 Pages** **20 Full-page Tables** **150 Engravings**

***Price, - $2.00 Postpaid***

Will be sent FREE to subscribers who send us in four paid-up yearly subscriptions to "The Power House."

## MACLEAN PUBLISHING COMPANY

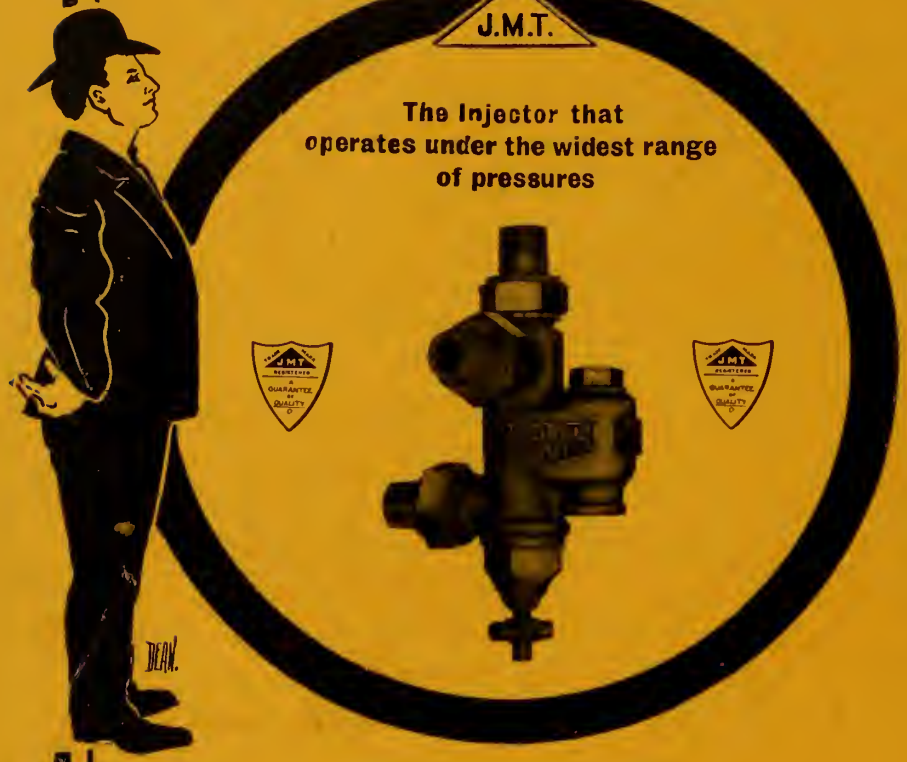
***TECHNICAL BOOK DEPARTMENT***

**10 Front Street East, Toronto**

# Engineers' Supplies

We Make the Largest Variety in

## BRASS and IRON GOODS




### Improved
### J. M. T. Injector

**Is the only one that will work at any pressure, varying from 18-20 lbs. up to 220 lbs.**

**Has Improved Drain Valve to prevent possibility of freezing in severe weather.**

**The general oonstruction embodies all the best features in injector requirements. Highest grade material and workmanship, to ensure efficiency and durability.**

## We Handle Everything Required for Steam and Water Installations

**Iron and Brass Valves and Cocks**
**Asbestos Packed Cooks**
**J. M. T. Y Blow-off Valve**
**Safety and Relief Valves**
**Steam Whistles—(1-in. to 14-in. diam.)**
**Steam Traps and Exhaust Heads**
**Steam and Vacuum Gauges**
**Engineers' Clocks, Revolution Counters**
**Pressure Recording Gauges**
**Engine Indicators with reducing motion**
**Lubricators, Oil Cups and Oil Pumps**
**Steam and Oil Separators, etc.**

**Iron Pipe, Pipe Fittings and Tools**

**YOU SHOULD TRY THE "GILBERT" PATENT GAUGE GLASS WASHER OR PROTECTOR--They make the glasses last**

**The JAMES MORRISON BRASS MANUFACTURING CO., Limited**

**93-97 Adelaide Street West, TORONTO**

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric Air and Water Power. Published by the MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg, London, Eng.

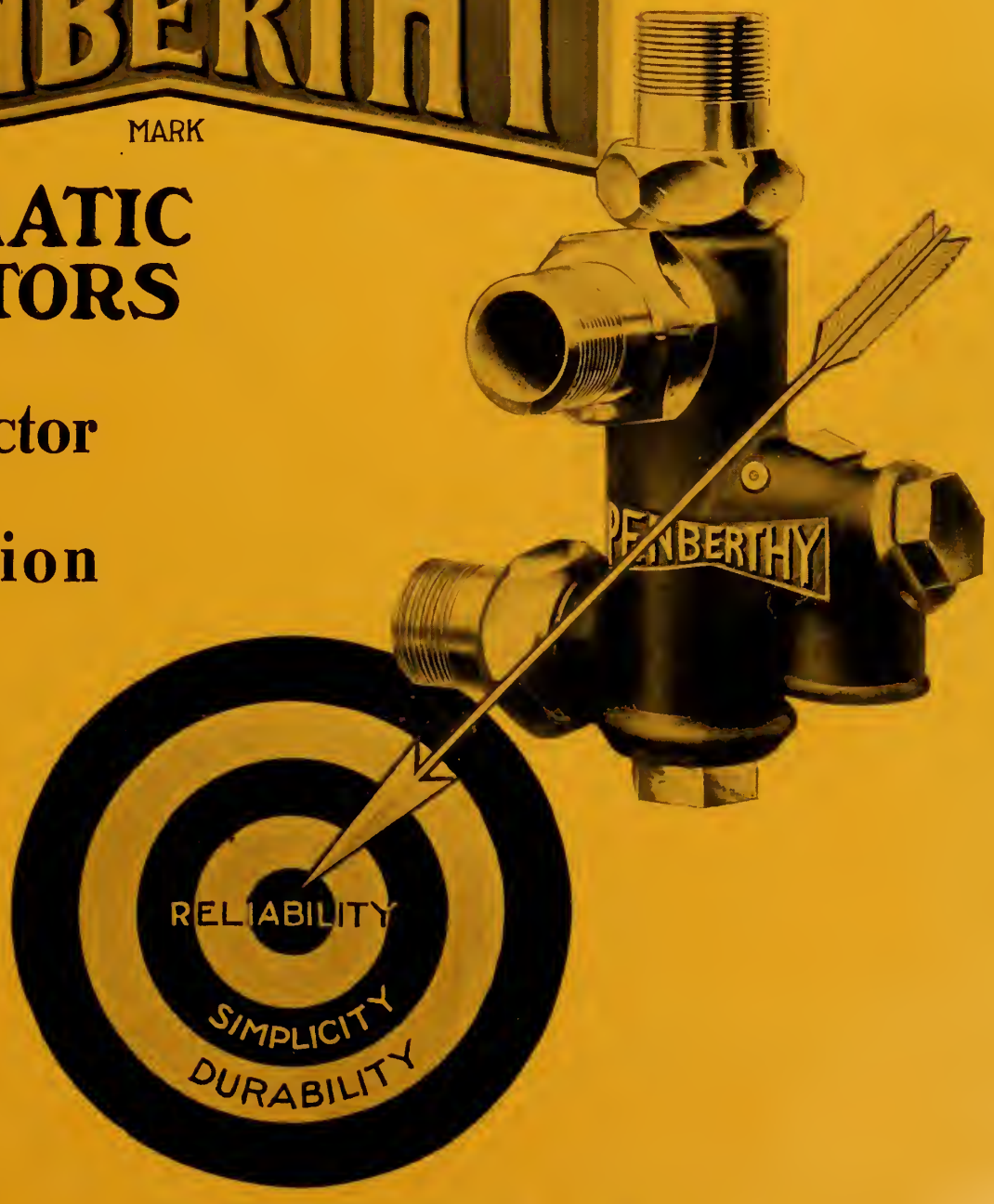
MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C

Vol. I. Publication Office, Toronto — October, 1908 No. 2

TRADE PENBERTHY MARK

AUTOMATIC INJECTORS

The Injector with a Reputation




The best by test.

Ask the Engineer.

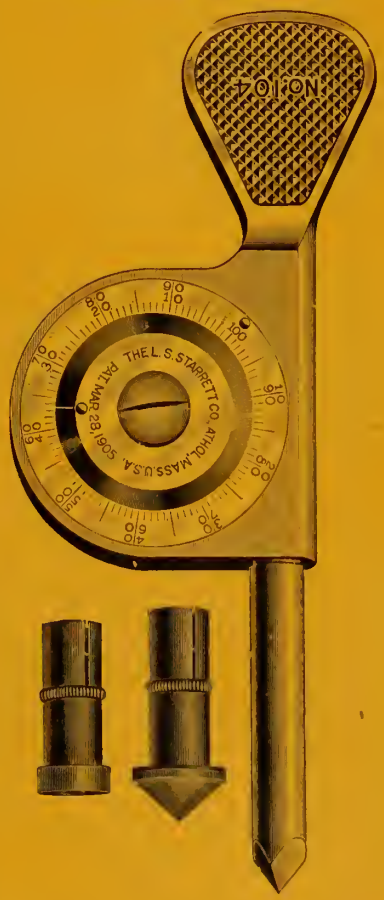
PENBERTHY INJECTOR COMPANY, LIMITED, WINDSOR, ONT.

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**



**STARRETT RECISTERING SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**

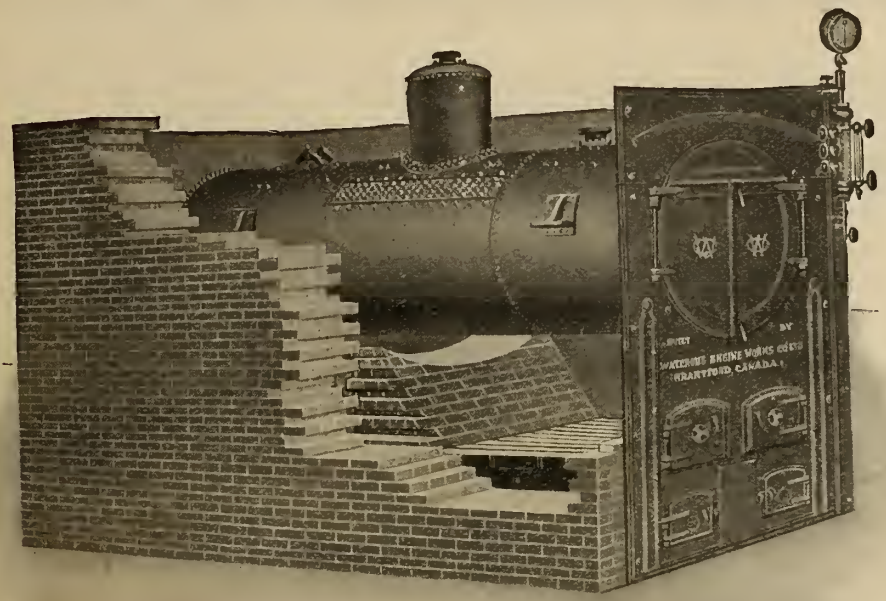
"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

Start in TO-DAY to earn one of these Handy Tools.

**THE POWER HOUSE, 10 Front Street East, Toronto**

# STEAM PLANTS

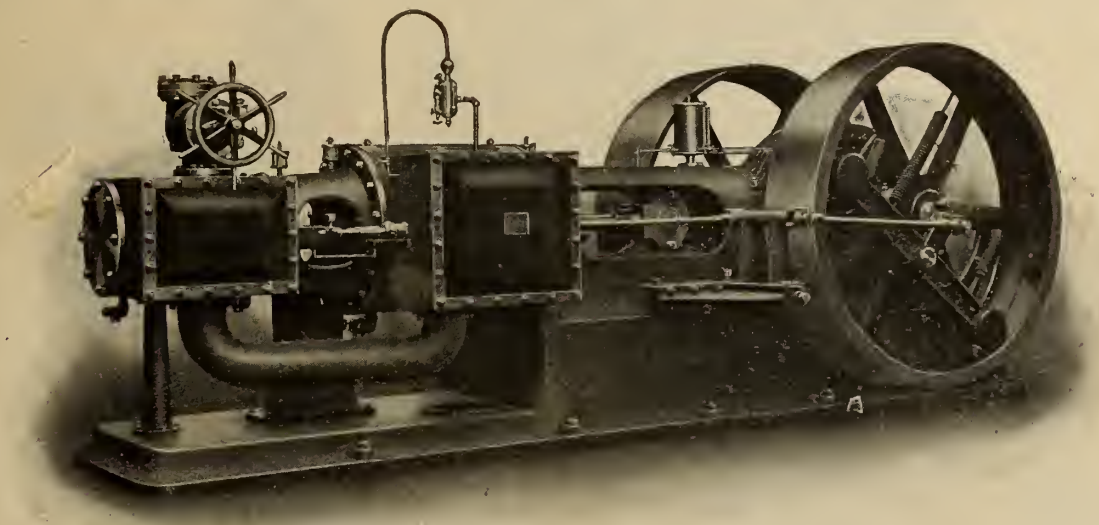



## Standard Tubular Stationary Boilers

The cut represents this style of boiler with ordinary full front setting. Half front and different styles of oven settings can be furnished if desired.

These boilers are built for various pressures and from 10 to 200 horsepower.

For further details and particulars ask for our special Boiler Catalogue, which will be gladly furnished on application.



*350 H. P. Tandem Compound Automatic McEwen.*

We manufacture : Boilers, all types ; Stationary, Marine, Automatic, Simple and Compound Engines ; Steam Plant Accessories.

**Write for Bulletin and Prices**

## The Waterous Engine Works Co., Limited

**BRANTFORD - ONTARIO**

***Western Branch : Winnipeg, Man.*** ***B.C. Agent : H. B. Gilmour, Vancouver***

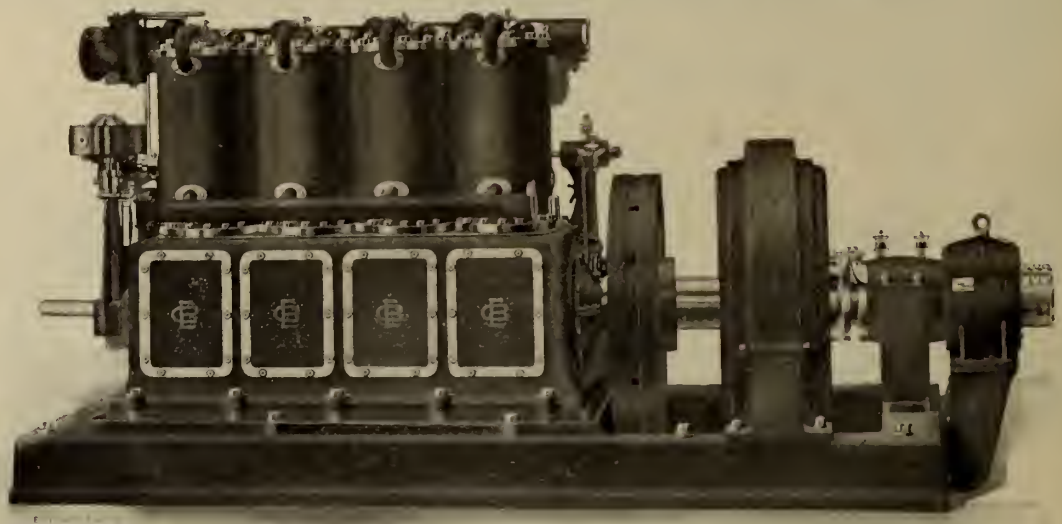
# The Gas and Electric Power Co.

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants
## Pressure Gas Plants

10 to 1,500 B. H. P.

Great Economy in Working.
Extreme Simplicity.
Plant occupying the smallest amount of space.

Little or no Cost in Repairs.
No Gas Holder. No Boiler.
No Chimney. No Smoke. No Soot.
No Smell. No Danger.



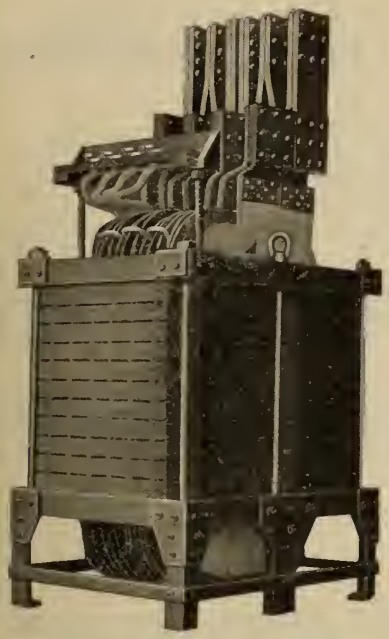
Ready for use in 20 minutes. Low Initial Expense.
Saving 50 to 80 per cent. over steam.
Engine direct connected to Alternators.
Guaranteed to run in parallel successfully.

## Complete Plants Equipped and Erected.

PRICES AND PARTICULARS FROM

# The Gas and Electric Power Co.

STAIR BUILDING, BAY STREET
TORONTO



750 K.W., 25 Cycle
1,200 Volt Transformer

**Packard Transformers are recognized as the standard of reliability for all classes of Power service.**

# The Packard Electric Co., Limited

Head Office and Works, - St. Catharines, Ont.
Western Office, - Somerset Bldg., Winnipeg
Eastern Office, - - Bell Telephone Bldg., Montreal

**Type D. Induction Motors are built for severe service, strong and rugged in construction, great overload capacity, high efficiency and low temperature rise.**

20 H.P. Induction Motor. Type D.

# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

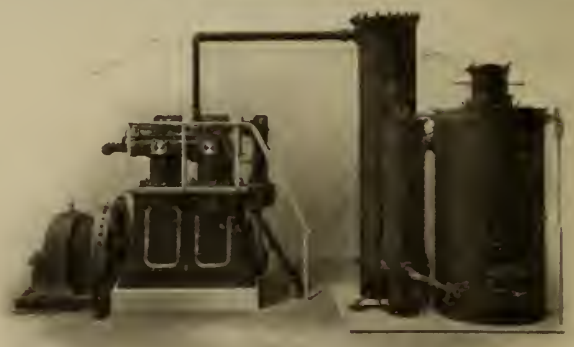
**KILMER & PULLEN,** 505 McKinnon Building, TORONTO

# Reliable As Steam—But Cheaper

In a nutshell, that is what we claim and absolutely prove for the

# Warren Gas Power Plant

Within four hours' travel of Toronto no less than 10,000 h.p. of Warren Engines are giving perfect satisfaction. Our liberal selling plan puts the onus of proof on us before you sign a single cheque.



Cut shows the Warren Vertical Automatic Gas Engine and Suction Gas Producer, manufactured by the Struthers-Wells Co., Warren, Pennsylvania, in sizes to 300 h.p. Other equally efficient types, from 10 to 1,000 h.p.

WRITE US FOR ILLUSTRATED LITERATURE !

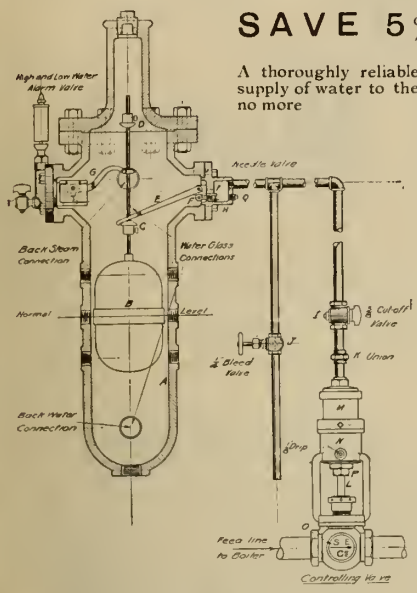
## W. H. OLIVER & CO.

EXCLUSIVE CANADIAN SALES AGENTS

M. 509, McKinnon Building, TORONTO

# STANDARD AUTOMATIC BOILER FEED REGULATORS

## SAVE 5% IN FUEL




A thoroughly reliable machine that regulates the supply of water to the boiler just as required, and no more

Maintains a constant level of water in the boiler, within one half inch from where wanted. Gives you the maximum space for steam.

Saves expansion and contraction due to hand feeding.

Made of the best materials and built interchangeably on the Universal system.

All valves can be removed for inspection while boiler is in operation.

Absolutely prevents explosions due to low water.

Few and simple parts, therefore reliable in operation.

Drawing No. C-105 sent free to Engineers.

***A Necessity on Every Boiler.***

SEND FOR DESCRIPTIVE PAMPHLET—FREE ON REQUEST

**The Standard Engineering Co.**

STEAM SPECIALTIES DEPARTMENT

43 Scott St. - TORONTO, CAN.



# POWER

## Nagle Corliss Engines

High Speed Slide Valve 5 to 300 H.P.

## "Rusten" Suction Gas Plants

8 to 100 H.P.

## Boilers

**Horizontal**
**Vertical**
**Locomotive**

PUMPING MACHINERY & TRANSMISSION SUPPLIES

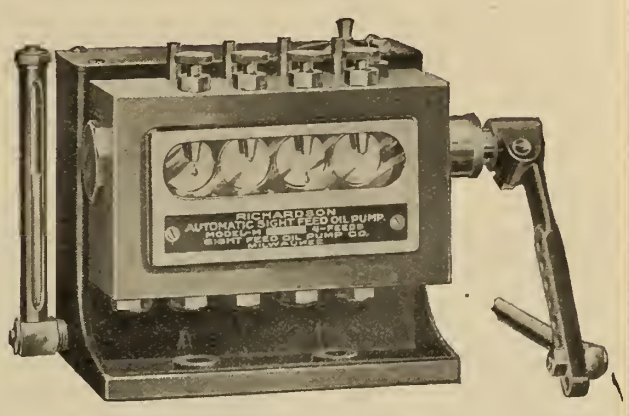
## Canada Machinery Agency

**W. H. NOLAN, Prop.**

298 St. James Street **MONTREAL**



# The Model "M" Method




¶ You know that the most economical and perfect lubrication is secured by an automatic oil pump that positively delivers small quantities of oil to the steam at very frequent intervals.

¶ Tool steel polished plungers, hardened check valves, adjustable metallic packing, and other refinements of construction are a part of the interesting details of Model "M."

¶ The Model "M" Method! Do you know about it? Told in Bulletin No. 109-L.

**MANUFACTURED BY**

# SIGHT FEED OIL PUMP CO.

MILWAUKEE, - - WIS. U.S.A.

# Imperial Genuine Babbitt Metal

## Guaranteed the Highest Grade Bearing Metal Made For All Bearings Carrying Extremely Heavy Loads

**Babbitt Metals and Bronze Castings our Specialty**

WHEN melted flows freely, will not shrink. Is very tough and durable, tin being the basis, antimony, and nickel for hardening, and toughened with pure copper. Contains no lead. Imperial metal is the best metal that can be made for heavy work on high speeds. Great toughness and hardness render them particularly adapted for bearings subjected to constant concussion, blows and jars, as is the case in crank pins, cross heads, main pillow blocks of large shafts, railway armature, heavy engines, street railway and heavy sawmill machinery, hydraulic pumps, crushing rolls. High anti-friction qualities preventing heating, toughness, and hardness preventing breaking or beating out.

This metal is especially made for bearings carrying extremely heavy loads and has this company's guarantee behind every pound.

**Sold in 25-lb., 50-lb. or 100-lb. Cases**

**Engineers to be Absolutely Sure Specify This Metal**

## The CANADA METAL CO., Limited

**William Street** **TORONTO**

**Every Manufacturer Using a Steam Boiler Should Know**
that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)
IS THE
GUARANTEED BOILER CLEANER

Manufactured by
**The CANADA CHEMICAL MANUFACTURING COMPANY, Limited**
Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL

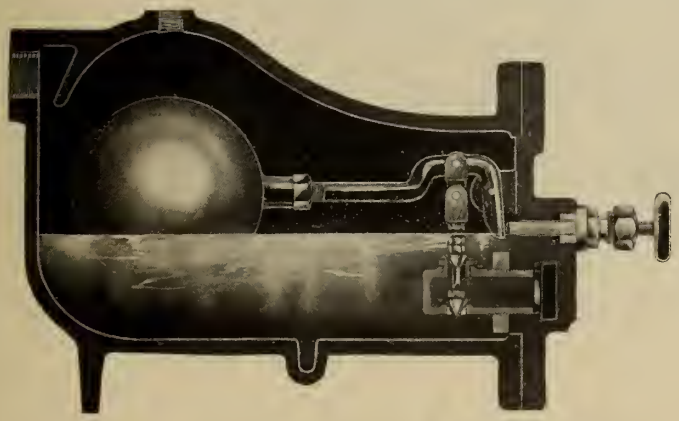
# The "Philadelphia" Grease Cup

Automatic application of grease to the bearings without the use of spring compression.

**Nature Supplies the Feeding Force in the form of Compressed Air**

The combination of the "Philadelphia" Cup and any good cup grease on the market insures satisfactory lubrication with a saving of at least 50 per cent. over any other system. That is our guarantee, and thousands of our cups in daily operation are more than "making good." If you want to know why and wherefore, drop us a postal. We are here to answer questions.

**The Peterborough Lubricator Manufacturing Co., Ltd.**
Peterborough, Ontario, Canada



## The Modern Steam Trap

# Sheldon Continuous Flow Float Trap

**Adapted for High or Low Pressure Work**

Greater capacity than single valve traps.
Discharges continuously as fast as the water enters.
Double cone-shaped balanced valves operated by a high pressure seamless copper float, tested to 300 pounds pressure.
The conical shape of the valves makes it impossible for them to stick or be affected in any way by foreign matter which may enter the trap.
All working parts attached to the trap cover, which can be removed without disturbing the inlet or outlet pipe connections.
By-pass valve in cover so steam can be given a free passage around the valves when desired.
Casing provided with bosses which are tapped for gauge glass and air cock.

Write for Sectional Catalogue No. 56.

Eastern Agents:
**ROSS & GREIG**
**225 St. James Street**
**Montreal, P.Q.**

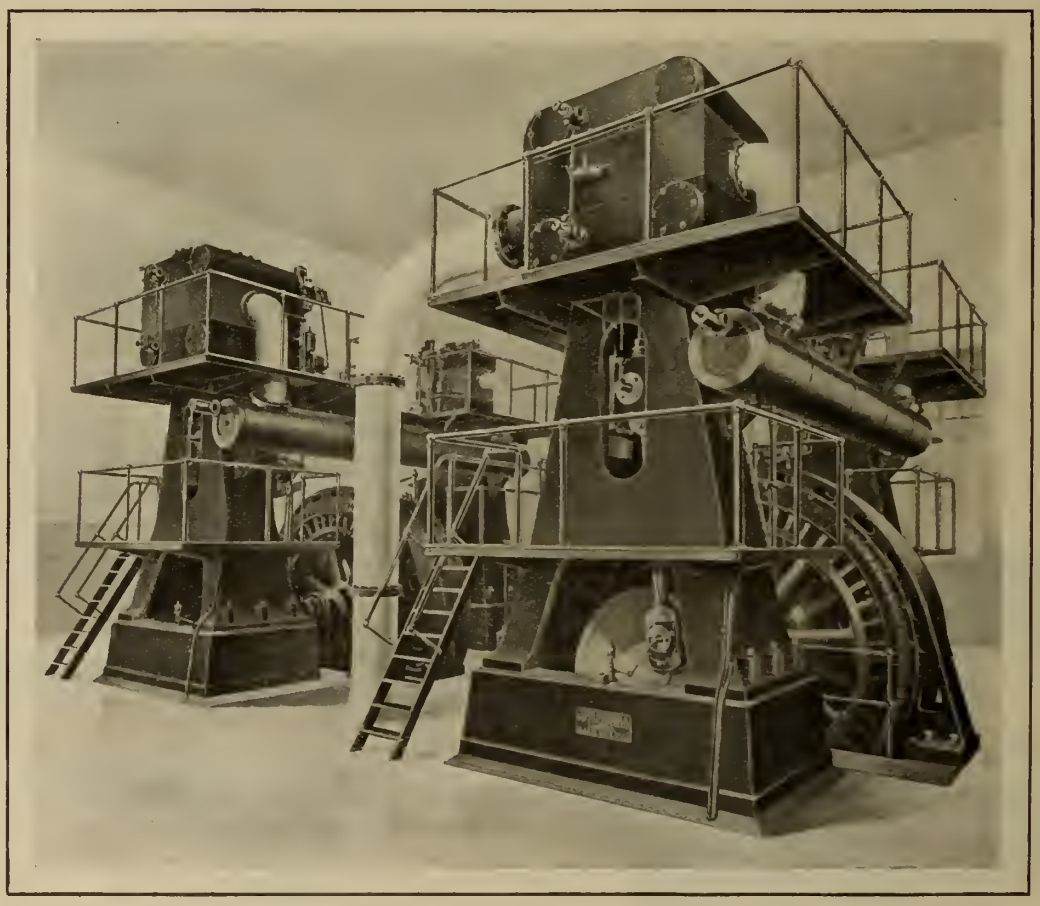
# SHELDONS LIMITED

**GALT, ONTARIO, CANADA**

**Stocked in all sizes for immediate shipment.**

# POWER EQUIPMENT

**Goldie Corliss, Wheelock Slow Speed and Ideal High Speed Steam Engines. Boilers, Heaters, Pumps and Condensers. Transmission and Elevating Machinery.**



The Power House of the **Dominion Iron & Steel Co.'s Plant** at **Sydney, N.S.** Equipped with two pair of **Vertical Cross Compound Goldie Corliss Engines.**

*ASK FOR CATALOGUES, PRICES AND ALL INFORMATION*

## The Goldie & McCulloch Co., Limited

### GALT, ONTARIO, CANADA

WESTERN BRANCH,
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS,
Ross & Greig, Montreal, Que.

B. C. SELLING AGENTS,
Robt. Hamilton & Co., Vancouver, B.C.

# The Care and Inspection of Boilers and Machinery*

## The Necessity for Personal Inspection of Machinery and Boilers in Particular — An Inspector Must Exercise Tact and Diplomacy.

By J. W. RAUSCH

In this paper I wish in a general way to say a few words regarding the personal factor in connection with the care and inspection of boilers and machinery. It is an old maxim that "Men are different and always will be different," I question whether there is anyone who appreciates this more keenly than an inspector who is constantly in touch with all kinds and manner of men. Indeed, I feel sure that you inspectors will agree with me that there is often a very material difference of opinion regarding things about a plant, especially if the question pertains to the necessity or practicability of guarding certain machinery, and it is this difference of opinion that brings into play the various personal factors, which often make the inspector's duty a most trying one. At some plants care is exercised to keep everything in first-class condition. The work is done in an orderly and systematic manner, and everything possible consistent with the nature of the business appears to be done for the welfare and safety of the employes. It is a pleasure to make an inspection at a plant of this kind, not because the inspection is less thorough, but the inspector knows that if he does find anything which is dangerous and liable to cause accident, such dangerous defects will be remedied if a practical way can be devised.

Unfortunately, however, there are many plants where the conditions are just the opposite. The inspector at the outset is looked upon with suspicion. The superintendent or manager at the plant may be more interested in turning out large quantities of goods at the least possible expense than in the safety of the employes. He may be aware of the fact that certain safeguards recommended by the inspector are absolutely necessary for safety, but is afraid that they will hamper the work, and instead of giving the improvements a fair trial, a letter is liable to find its way to the office of the chief inspector, complaining that the inspector is too critical and is insisting upon impracticable things. Thoroughly competent engineers are sometimes of an exceedingly jealous and sensitive disposition, and are under the impression that their ability is questioned when an inspection is made of the machinery, boilers and other appurtenances, of which they may be in charge. This is all wrong. Banks and trust companies are periodically examined by Government examiners, yet no one would question the ability of the officials of the banks and trust companies because of such examination.

### Keep Up With the Times.

It should be remembered in these times of rapid development that new appliances and devices are constantly being put on the market. This appears to be especially true in the engineering line and we must indeed be wide awake if we wish to keep abreast of the times. The inspector visits different plants every day, and the very nature of his work is such that he picks up information and acquires a knowledge of matters pertaining to steam plants that could not be obtained in any other way. It is, therefore, reasonable to suppose that he can often suggest improvements even to the competent engineer, and he may also exchange ideas with the engineer to the mutual benefit of both. Then, there is the engineer who does things knowing that they are dangerous, but who is reckless and would rather take chances than encounter inconvenience. For example, inspectors often find the governor of an overloaded engine blocked. The engineer knows full well that the belt of an overloaded engine is under its most severe strain and that it is liable to break at any time. He also knows that if the belt does break, the engine will be adrift and race immediately, for the simple reason that with the governor blocked there is nothing to control the speed, and a disastrous fly-wheel explosion is inevitable ; and this is only one of the many causes which, combined with a blocked governor, result in fly-wheel explosions. Strange to say this is being done every day and sometimes with the full knowledge of the management. This practice cannot be condemned too severely, for while the engineer may be willing to risk his life and the manager may be willing to run the chances of a heavy property loss, they certainly have no right to jeopardize the lives of the employes and other persons who may be about the plant.

Blocking the safety attachment of a passenger elevator is another favorite pastime with some men, who do this rather than take the trouble of adjusting the governor to the proper speed limit. Imagine an elevator full of passengers with the safety attachment purposely put out of commission because it is found a little troublesome to adjust it—yet I have personally found cases of this kind, and in one instance was told by the man in charge that safeties as a rule did not work anyway in the event of accident. However, safeties do work, and the necessity of keeping safety attachments in proper working order can not be too strongly emphasized. It is true that no mechanical device is absolutely reliable under all conditions, but thorough inspections and the proper care of safety attachments have in actual experience prevented many accidents.

### Chief Engineer Should Personally Inspect.

It may not be amiss to say a few words regarding the engineer who depends entirely upon his subordinates. It it true that the responsible head of a large engineering plant cannot be expected and neither would he have the time to look after every detail, but as will be shown by the following experience, which is only one of many, a personal inspection now and then will often pay well. One of our inspectors visited an unusually large power plant for the purpose of inspecting boilers. Everything about the plant was apparently in the very best condition. At this plant special men are detailed to do nothing but look after the repairs and the cleaning out of the boilers. The chief engineer pointed to one of the boilers, saying, "You may start on that one, but I hardly think it necessary to get inside as I have just received a report from the man in charge, who reports everything in first-class condition," and on holding a light inside of the manhole the boiler certainly did look to be in excellent condition. However, the inspector, like the man from Missouri, "wanted to see," and it is well that he did. He first got into the manhole above the tubes. The tubes were found fairly clean, but a solid mass of scale was found on the back head between the tubes and the shell. This scale extended down to the lower row of tubes, the water space being solid with scale for a distance of one foot from the back

* Paper read by J. W. Rausch, superintendent inspection division, Maryland Casualty Co., Baltimore, at convention of International Association of Factory Inspectors, Toronto.

head ; also both sides were practically the same. In breaking out the scale we succeeded in getting a piece 12 inches long, three inches thick and six inches wide. An external examination showed that the shell plates at the points where the scale was found were very badly bulged and burnt. The rivets and the edge of the lap of the head seam were nearly gone. In order to put the boiler in safe condition, extensive repairs were necessary.

Recognizing the importance of the proper care and management of steam boilers and the necessity of certain definite action in case of an emergency, we have prepared certain rules and instructions. These boiler room rules are printed on cardboard eight and one-half by twelve inches. We have found this a convenient size, and they are usually posted in boiler rooms by our inspectors so as to be constantly before the fireman. Careful attention to these rules will go a long way toward prolonging the life of boilers and preventing accidents.

Specimen of Scale Found in Tubes and Boilers by Boiler Inspector.

### Inspectors Must Exercise Tact.

In citing the above cases, I have tried to bring out a few of the conditions met with by the inspector, but how about the inspector himself ? Is he always courteous, and is he always clear and concise in his recommendations ? Then, too, I believe we will have to admit that inspectors like doctors do not always agree, and that in a controversy it is not always the fault of the management at the factory.

If the inspector finds anything about a plant which is dangerous, he should confine his remarks to the proper person or persons, and submit his report according to the instructions of his chief. It may at times be advisable in order to emphasize the necessity of certain safeguards to refer to other plants, and if the inspector will use discretion there can be no harm in this. On the contrary, it will go a long way toward convincing the management that certain safeguards are necessary if he can show from actual experience that accidents have occurred due to the lack of them. What we need is a better understanding between the management at the plant and the inspectors. Let the owners know that inspections are not made with a view of criticizing or finding fault, but that we want to help them. We are all working for one common good, aad in order to obtain the best results, we must co-operate with each other.

### Boiler Room Rules.

1. Immediately upon entering the boiler room ascertain, beyond a doubt, whether the water in the boiler is at the proper level.

2. In case of low water with fire in the furnace do not draw the fire, as this will intensify the heat and make matters worse, but immediately cover the fire with ashes or fresh coal (wet ashes or slack coal preferred) and close the ash doors. Do not, under any circumstances, turn on the feed water or touch the safety valve. Let ALL the steam outlets REMAIN as they are until the boiler has cooled off.

3. Keep the gauge cocks clean and try them frequently. See to it that all the connections to the water glass and water column are free. Do not depend upon the water glass.

4. Keep the boiler clean and dry on outside. Do not allow wet ashes to accumulate around water legs or other parts of boiler. Do not allow water from leaking joints or other sources to come in contact with boiler. Failure to observe these rules will cause corrosion.

5. Leaks, no matter how slight, should be repaired immediately, otherwise they will become worse and cause corrosion and grooving.

6. Keep boiler clean internally. Do not allow scale, mud or oily matter to settle on the fire sheets, as it may cause the sheets to become burnt, bagged or buckled ; also rupture and explosion may result.

7. Try the safety valves frequently by carefully raising them from their seats. They sometimes stick. Care should, therefore, be exercised to keep them in good working order. If the safety valve is not blowing freely when the pressure gauge indicates the stipulated pressure allowed in the inspection certificate the cause should be ascertained immediately.

8. The blow-off valves should be opened wide for a moment daily. This will aid in keeping boiler and blow-off clean, but NEVER open the blow-off valve or cock with a jerk, as it is liable to let go and cause a serious accident.

9. Bags should be repaired immediately. If not down too far and the metal is sound, they can sometimes be driven back, otherwise it will be necessary to cut out and patch.

10. In case of foaming, close the throttle and open the fire doors for a few minutes, when the water will usually settle and the proper height may be ascertained. The trouble, if caused by dirty water, can easily be overcome by feeding and blowing. Where there is a surface blow it can be used to good advantage.

11. Do not blow off under pressure when intending to clean out, as the heat of the boiler and the brickwork will bake the mud and scale on the shell and tubes, making it extremely difficult to remove. Allow the boiler and brickwork to cool. Boiler should then be drained and thoroughly cleaned and washed out, both from the top and bottom. Boiler should be cleaned out at intervals frequent enough to keep it clean and free from scale.

12. Do not close the damper entirely with fire in the furnace, as gas is liable to accumulate in the combustion chamber or tubes and cause an explosion.

13. Keep all connections and appurtenances in good working order and keep everything about the boiler room clean and neat. In case of accident, keep cool but act promptly and with precision.

# Features and Test of Lea-Degen High-Duty Turbine Pump

## Pumps are of Unit Construction—Design and Special Features—Capacity and Efficiency Test on a Ten Inch Two Stage Centrifugal Pump.

By J. E. DENTON *

The complete line of pumps are designed for heads from 7 to 1,000 feet or higher, and their capacities ranging from 75 gallons to 30,000 gallons per minute. Being built in separable units and parted both horizontally and vertically, it is possible to quickly assemble any number of stages required, and by the use of a small number of standard parts an endless variety of combinations can be produced. After these sections are bolted together the top can be easily removed, allowing inspection of packing and wheels.

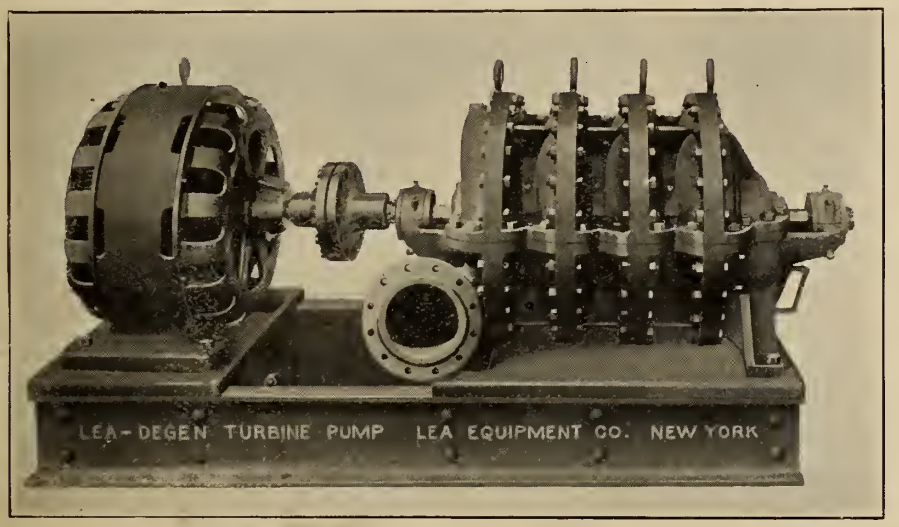



Fig. 1—10-inch Four Stage Turbine Pump Connected to Induction Motor.

The packing consists of right-angle cup-leathers, held in place by springs in such a manner that they are tight under all conditions; allow the shaft to oscillate throughout any distance necessary, and are quickly renewable.

Both suction and discharge water connections are placed below the centre line of the pump, allowing removal of top without breaking water connections.

The shafts are made straight throughout their length with no shoulders, except at the bearings. The wheels are held in place by taper bronze sleeves, allowing the easy removal of impellers, even should parts become rusted. These sleeves cover the shaft throughout its exposed parts, and also form parts of automatic packing. Bearings are all of a self-oiled type; have no connection whatever with the suction or discharge line, and it is impossible for water to leak into them. Bases are made from cast iron distance pieces, bolted to steel channel beams. By this plan it is possible to quickly deliver bases of any length or sizes required.

By the method of unit construction it is possible to quickly assemble a pump for almost any general requirements—one that is accessible and of high efficiency. Fig. 1 is a view of a 10-inch four stage turbine pump, connected to an induction motor, capacity, 2,400 G.P.M. to 568-foot Head, and Fig. 2 is a section through the centre of the same pump.

The pump tested was a ten-inch, two-stage motor-driven, consisting of two shrouded runners, or pump wheels, mounted on the same shaft in a double case. The case is so partitioned that the water is drawn from the source of supply and put under pressure by the first wheel, and then delivered to the suction chamber of the second wheel. The second wheel then imparts to the water the same amount of energy it receives from the first wheel, thereby increasing the pressure, and then delivers the water into a spiral discharge conduit terminating in a diverging nozzle connecting with the main pipe.

**Dimensions and Features of Pump.**

| | Inches. |
|---|---|
| Diameter of suction pipe ..... | 10 |
| Diameter of discharge pipe ..... | 10 |
| Outline diameter of each wheel ... | 24 |
| Number of Blades ..... | 8 |

The special features of the pump

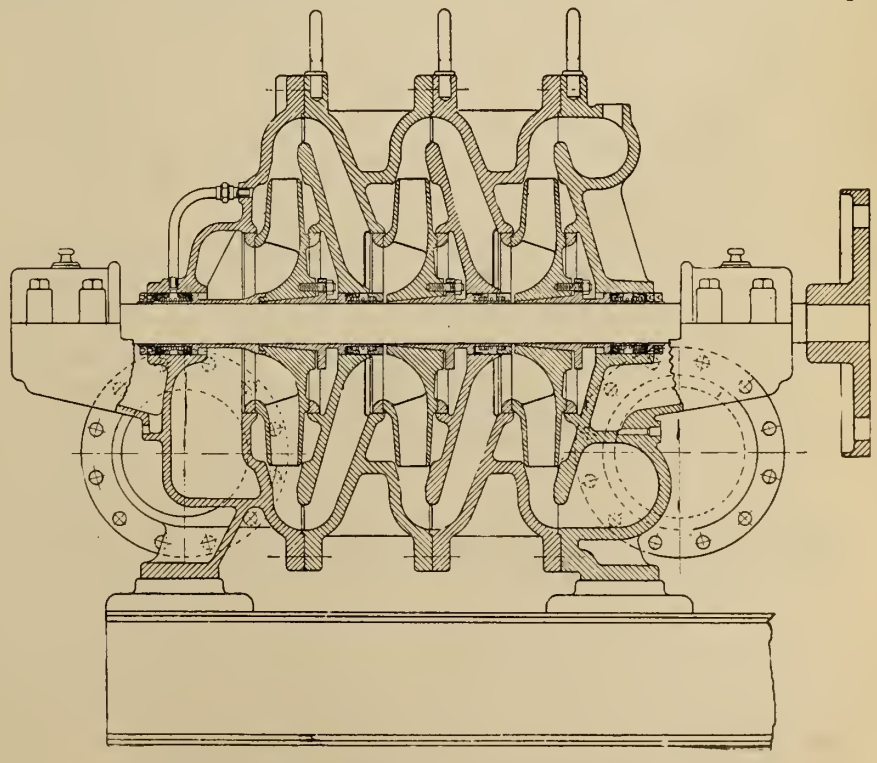


Fig .2—Section Through Turbine Pump

*Prof. in Engineering Practice, Stevens' Institute of Technology, Hoboken, N.J.

which represent patented advantages are as follows:

1. The case is divided through its horizontal diameter by bolted flanges so that its top half can be quickly freed, and lifted off, without disturbing either suction or discharge connections, thereby affording easy access to the internal parts of all the stages at once.

2. By means of bolted circumferential divisions of the case, provision is made for either using the suction and discharge end of a case together as a single-stage pump, or for adding as many intermediate sections as may be necessary to afford any desired pressure at any fixed speed. Additional stages can therefore be installed after a pump has been in operation without wasting any parts of the existing case.

3. A special arrangement of double cup-leather packing is used for both the suction and discharge ends and for the intermediate sections. The cup leathers are held against a flat collar, on extended pump-wheel-sleeves, in such a manner that the leathers can follow up as they, or the collars are worn, or the shaft may be shifted at will in either direction, with the leathers following, without changing the location of the leather with relation to the shaft collar, thus making a practically water-tight joint at all times. A spiral spring is used, between each pair of cup leathers, to ensure their seating against the collars before pressure is put on the pump. Provision is made for setting out the leather packing on the suction end of the shaft by the water pressure of the high side of the pump.

4. On the outside of main bearings, at each end, is placed a ball thrust-bearing, with adjusting collars, for shifting the shaft endways to balance the end thrust of the pump runners. The balancing is accomplished by means of variation in the width of water space, on both sides of the wheels between the rim of wheel and the case. Experiment showed that as the wheel was moved laterally in the case, the pressure between the wheel and case increased on the side where the clearance was greatest, and was reduced on the opposite side.

The pump was designed by Mr. Degen for practically equal efficiency for the range of speed between 400 and 600 revolutions per minute. Therefore an efficiency test was made at 400, 500 and 600 revolutions, respectively.

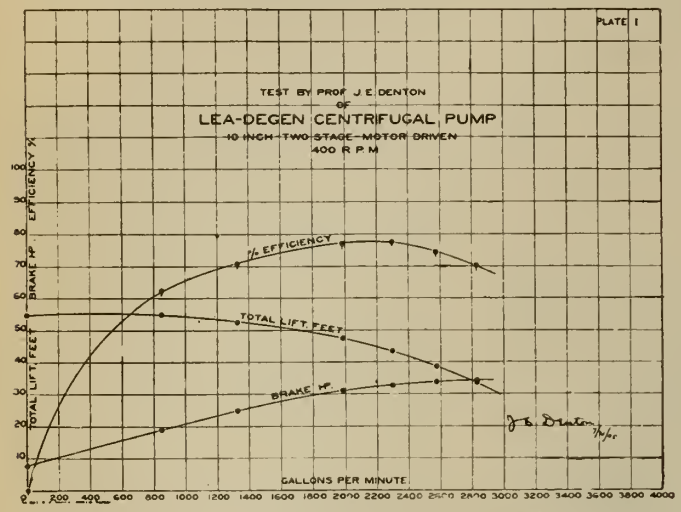



Fig. 3—"Gallons-lift" Curve for 400 R.P.M. Pump.

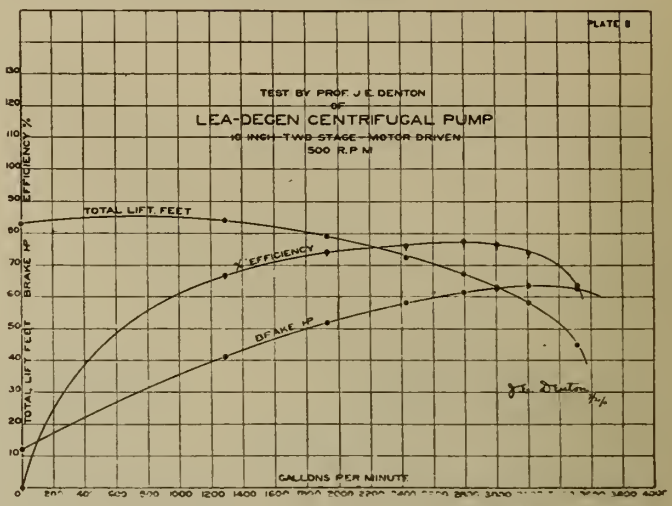



Fig. 4—"Gallons-lift" Curve for 500 R.P.M. Pump.

At each speed the steps in the determination of the maximum efficiency were as follows:

The pump was primed* with the throttle-valve closed.

The throttle-valve was then set wide open, and connection made with the mercury-columns, which had been previously filled with water between the mercury and the cock connecting them to the main pipe. The speed was then adjusted by a rheostat, and the required data were observed at 5-minute intervals until the average of the readings was practically constant. The throttle-valve was then reset to secure a series of re-

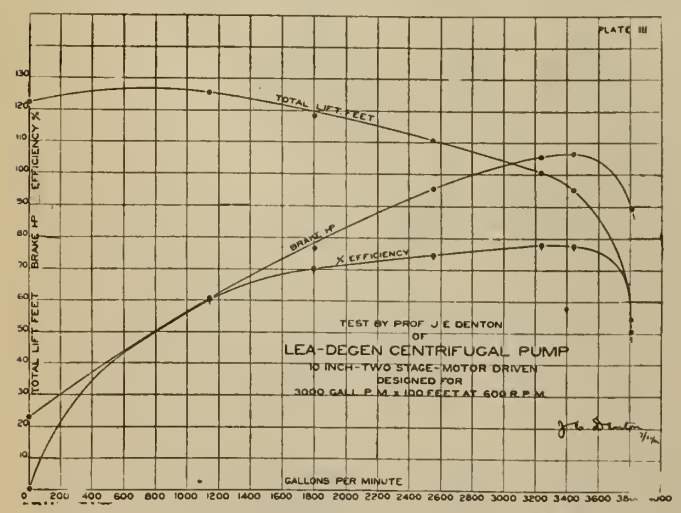



Fig. 5—"Gallons-lift" Curve for 600 R.P.M. Pump.

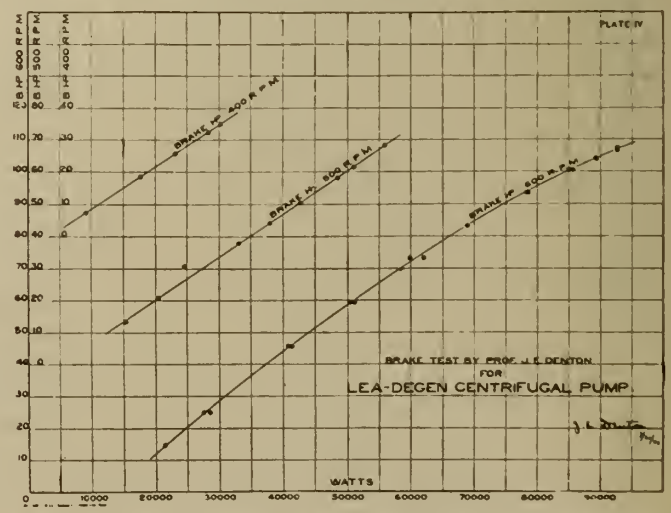


PLATE IV
E B HP 600 R P M
E B HP 500 R P M
E B HP 400 R P M
BRAKE HP 400 R P M
BRAKE HP 500 R P M
BRAKE HP 600 R P M
BRAKE TEST BY PROF J E DENTON
FOR
LEA-DEGEN CENTRIFUGAL PUMP
WATTS

Fig. 6—Brake—Horse-power Watts Curve Turbine Pump.

*The priming was done by water from the city mains acting through a $1\frac{1}{4}$ inch Penberthy ejector, no foot-valve being used on the suction pipe.

duced rates of flow, which, by preliminary tests, were known to be sufficient to establish the gallons-lift curve, Figs. 3, 4 and 5. No data were recorded at a speed varying more than two revolutions from the assigned speed, a skilled assistant devoting his attention to this point. After the gallons-lift curves were secured, the pump was disconnected from the motor, and the power of the latter absorbed by a prony brake over the same range of watts applied to drive the motor during the pump tests. Thereby the Brake HP-Watts curves,* Fig. 6, were established.

From these curves the horse-power corresponding to the watts applied to drive the motor during the pump tests was determined and taken as the horse-power to drive the pump. Column 6 of pump test table.

The useful work of the pump is column 5,

$$\text{Water horse-power} = \begin{cases} \dfrac{\text{lbs. water delivered per minute} \times \text{Total lift in feet}}{33000} \\ 0.000252 \times \text{gallons per minute} \times \text{Total lift in feet.} \end{cases}$$

The total lift is the sum of the suction vacuum, and the pressure (column 3) in front of the throttle-valve, expressed in feet of water.

The efficiency is then (column 11).

$$E = \frac{\text{Water horse-power}}{\text{Horse-power to drive pump}}$$

The prony brake was of the two-semi-circular, solid-block type applied to a 28-inch pulley, with a 6-foot lever-arm acting on a knife-edge on a tested platform-scales. It was carefully balanced with its pulley by mounting the whole combination, with a mandril through the pulley, on straight-edges. A copious stream of water applied to a nipple in the top block, through a long vertical flexible hose, and a hand-tightened wheel, with a leverage of 1,000 to 1, enabled the highest loads to be maintained indefinitely with a very steady equipoise of the scale-beam. The electrical readings were made from a Weston instrument from the laboratory of the Stevens Institute.

The ratio of the quantity of water given by the weir to that given by the pitot tube is shown in column 8. This ratio is the value of the co-efficient C in the formula for cubic feet per second.

$$Q_1 = C \times \text{Area of nozzle} \times \sqrt{2g \times \text{pilot head.}}$$

*For 400 and 500 revolutions these curves are straight lines, but at 600 revolutions, the straight line does not obtain, probably because the speed had to be regulated by changing the position of the brushes.

The tests show that the pump afforded the following results under conditions of maximum efficiency:

At 400 revs. 77.7 per cent. eff. with a cap. of 2296 gals, under 43.6 ft. lift.

At 500 revs. 77.6 per cent. eff. with a cap. of 2794 gals, under 67.4 ft. lift.

At 600 revs. 77.97 per cent. eff. with a cap. of 3235 gals. under 100.7 ft. lift.

**RESULTS OF PUMP TEST.**

| Weir gallons per min. | Total lift. Feet. | Outlet pressure. Feet. | Suction lift. Feet. | Water horse-power | Horse power ty drive pump. | Weir height. Feet. | Pitot atlo. | Watts to drive motor. | Revs. per min. | Efficiency. |
|---|---|---|---|---|---|---|---|---|---|---|
| TABLE 1, 400 REVOLUTIONS. | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 2828 | 33.65 | 20.29 | 13.36 | 24.08 | 34.22 | 0.754 | 0.982 | 29830 | 401 | 70.37 |
| 2574 | 38.55 | 26.32 | 12.33 | 25.10 | 33.78 | 0.707 | 0.981 | 29484 | 402 | 74.30 |
| 2296 | 43.63 | 32.41 | 11.22 | 25.34 | 32.61 | 0.653 | 0.988 | 28576 | 400 | 77.70 |
| 1984 | 47.49 | 37.29 | 10.22 | 23.84 | 30.96 | 0.590 | 0.992 | 27300 | 401 | 77.00 |
| 1328 | 52.39 | 43.98 | 8.41 | 17.60 | 24.86 | 0.448 | .... | 22570 | 401 | 70.79 |
| 852 | 55.00 | 47.69 | 7.31 | 11.86 | 19.02 | 0.330 | .... | 18042 | 401 | 62.42 |
| 0 | 54.93 | 48.16 | 6.77 | 0 | 7.7 | 0.0 | .... | 9400 | 402 | 0 |
| TABLE 2, 500 REVOLUTIONS. | | | | | | | | | | |
| 3517 | 44.81 | 27.85 | 16.96 | 39.87 | 62.58 | 0.878 | 0.965 | 51700 | 501 | 63.71 |
| 3207 | 58.09 | 43.17 | 14.92 | 47.13 | 63.64 | 0.823 | 0.987 | 52496 | 500 | 74.05 |
| 3005 | 63.12 | 49.28 | 13.84 | 47.99 | 62.63 | 0.787 | 0.984 | 51736 | 500 | 76.62 |
| 2794 | 67.44 | 54.48 | 12.96 | 47.67 | 61.41 | 0.748 | 0.996 | 50830 | 500 | 77.62 |
| 2428 | 72.38 | 60.84 | 11.54 | 44.46 | 58.16 | 0.678 | 0.995 | 48400 | 500 | 76.04 |
| 1929 | 79.09 | 69,26 | 9.83 | 38.60 | 51.99 | 0.578 | 0.989 | 43800 | 500 | 74.24 |
| 1289 | 84.26 | 76.16 | 8.10 | 27.48 | 41.11 | 0.438 | .... | 35680 | 501 | 66.84 |
| 0 | 83.04 | 76.27 | 6.77 | 0 | 12.07 | 0.0 | .... | 14012 | 502 | 0 |
| TABLE 3, 600 REVOLUTIONS. | | | | | | | | | | |
| 3806 | 50.65 | 32.11 | 18.54 | 48.58 | 89.40 | 0.928 | 0.974 | 74365 | 600 | 54.34 |
| 3440 | 95.13 | 34.10 | 16.36 | 82.47 | 106.50 | 0.864 | 0.973 | 92115 | 600 | 77.44 |
| 3235 | 100.71 | 36.97 | 15.31 | 82.10 | 105.30 | 0.828 | 0.987 | 91052 | 600 | 77.97 |
| 2554 | 110.46 | 42.45 | 12.40 | 71.09 | 95.40 | 0.703 | 0.997 | 80220 | 600 | 74.52 |
| 1805 | 118.21 | 46.95 | 9.76 | 53.77 | 76.60 | 0.553 | 0.998 | 63300 | 598 | 70.19 |
| 1139 | 125.67 | 50.90 | 8.09 | 36.07 | 60.10 | 0.401 | .... | 51012 | 599 | 60.02 |
| 0 | 122.08 | 49.80 | 7.04 | 0 | 22.90 | 0.0 | .... | 26880 | 600 | 0 |

In round numbers, therefore, the capacity at maximum efficiency is directly proportional to the revolutions, and the lift, or head, is proportional to the square of the revolutions. At each speed the efficiency averaged more than 76 per cent. over a range of 600 gallons of capacity for the lower two speeds, and 900 gallons at the higher speed, the head remaining nearly constant.

These pumps are now being built by the Lea Equipment Co., 136 Liberty St., New York.

## A STORY OF BOILER EXPERIENCES

By R. Morly Orr.

Several years ago when I was just working my way into "engineering" I was after much hunting, successful in securing charge of a small plant which had seen 28 years of service. The two return tubular boilers of the power equipment showed their age in more respects than one and my first thought after an examination was to throw up the job. But I needed the money and I was "learning," so I stayed. Both boilers were badly scaled up, the girth seams leaked when the boilers were cold, the roof of the boiler room leaked and every bit of piping and the domes were badly rusted. The safety valves were loaded down with scrap iron that no pressure would ever raise. I was told that when the safety valves had been used a year or so before that they would not shut tight till they had blown off about 20 pounds of the pressure so they were weighted down to keep them from leaking and I would just have to watch my fires. The boilers were not insured and consequently were never inspected so I decided to keep the pressure about 80 pounds. My experience was very limited then, I could not repair the valves myself, but I realized the danger and was very careful.

One day the centrifugal oiler on the engine crank broke off and caught me with heavy coal fires under both boilers, for the load was very heavy. The only boiler feeding device in the plant was a belted plunger pump so that if I stopped the engine the feed water would be cut off. How did I keep the steam from rising? Well I let the engine run with a dry pin while I pulled open all the fire doors and filled the fire boxes about

a foot deep on top of the fire with ashes from a handy pile.

I was standing at the engine waiting for the steam to drop to about 60 pounds before shutting the throttle when along came the owner. The crank was smoking and pounding and his first words were: "Have you got no better sense than to run an engine like that. Shut her down!" I explained about the safety valves and steam pressure but he could not see the danger. "Shut her down," he commanded, "you're burning the crank."

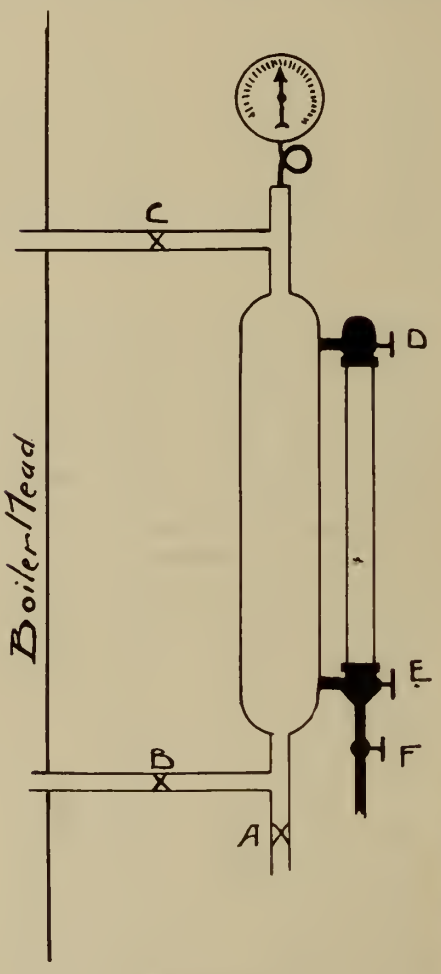
"Not till steam drops a little," I said. He made as if to take the throttle from me but I said "No. I'll not shut that throttle and you'll not either while I am here as engineer. If you want to shut it, discharge me. I'll leave the building and you can do as you please." He made no further attempt and in a few minutes steam went back and I shut down. Two hours put a new pipe on the oiler, fitted up the crank brasses and cleaned off the grates. Three months later I left the work there; a month after I was glad to hear that an electric motor had replaced the steam plant.

**Troubles With a Cheap Boiler.**

Not long ago my superintendent decided to instal a new boiler. A boiler insurance and inspection company were asked to advise and submit specifications for the boiler, which they did. Copies of these specifications were made and mailed to half a dozen firms with a request for tenders. Then the tempting commenced. Every firm, without an exception, wrote, "Find specifications very elaborate, can supply our standard boiler at much lower figure." The superintendent entered into correspondence with these firms and found that one firm wanted to use cheaper fittings, another objected to the butt strap joints, another to the expensive system of bracing and still another to the drilled rivet holes and so on until at last he grew sick of it all and said to me, "I'll make them tender to the specifications or drop out." The result is that today we have a boiler second to none in the country and we are not sorry that it is made to proper specifications.

Another mistake too often made by boiler owners is that of employing as night fireman a man whose knowledge of boilers and their care is sadly deficient. One night fireman had been on the job where I work, two nights. On coming to the boiler room before starting the engine the morning after, I found one of the boilers so full of water that I could not bring it down into the glass by opening the valve at A in the accompanying cut. I then went to the back of the boiler and opened the blow-off cock to take the water down. Returning to the glass I watched until I decided that I had blown out enough to bring down water level. I closed the blow-off cock and examined the water column again. On opening the valve F, the water went out of the glass and stayed out. For a moment I thought the flues were blown dry. He had pumped the water up till the glass was a little more than full and then in working the valves to see how high it was, had closed the valve E. When I opened E I found that there was just half an inch of water in the glass.

Next night there was a new fireman for this man was really not safe, one




Water Glass.

of his faults being that he was very easily "rattled." An engineer should be able to think rapidly and act quickly. He will often find it necessary to hurry, but to hurry does not mean to get excited. Ten times out of ten the man who keeps cool can accomplish most in the shortest time.

For cool-headedness, the following is well worth repeating. A friend of mine who is a boiler inspector was once called on to enter one of those stingy little man-holes which too many builders put in their boilers. The going in was a "squeeze auntie" but the boiler was hot and the inspector got a good sweat on and when it came to getting out there was trouble. After several vain attempts he sat down on the tubes with the expression: "By George, I'm stuck." The engineer who had been tugging at him from above commenced walking excitedly up and down the boiler top saying: "I'd give $10 if you were out—I wish—we'll have to cut—why how will we ever get you out—O—"

"Who's in this boiler, you or me?" roared the inspector at him.

"Why you are but I wish you were out."

"Well, if it's me that's in the box let me do the worrying if any needs to be done. Do what I tell you. Go down and bring me up the nozzle end of the hose." Soon the nozzle was in the inspector's hands. "Now go down and turn on the city water. Then go to the engine room, get my pipe, fill it and bring it here." The loaded pipe was soon handed down through the manhole. "Now sit down and rest yourself." For ten minutes my friend smoked his pipe and cooled off the inside of that hot boiler. By that time he had cooled off somewhat himself and taking off his jaeket he came out in his underwear quite easily. It always pays to have control of one's self.

---

**AN ELECTRICAL IDEA.**

A miller once on steam relied—
But soon the story ceases—
The "safety" stuck, the miller tried
To "ease it up" but it replied,

And spread him o'er the country side
In several hundred pieces.
If he had put a motor in
He had not quite so scattered been.
—Electric City, Chicago.

---

F. B. DeW. Lavender, C.E., Toronto, has taken up his residence in Bowmanville, where he has been appointed superintendent of the electric plant.

George B. Blanchard, Chicago, has entered the employ of the Dominion Power & Transmission Co., Ottawa, as electric railway expert.

# Solidified Oil for Lubrication of Machinery Bearings

## Recent Tests Have Shown that Solidified Oil is an Efficient Reducer of Friction, and Contains the Ingredients of a Good Lubricant.

By W. BOEREMA *

Many and sharp have been the arguments, pro and con, concerning the relative values of grease and oil as lubricants. Much may be said in favor of both ; but the object of this article is to demonstrate, from facts gathered from reliable sources and covering a wide range of experiences during many years past, that the use of the right kind of greases, properly applied to bearings, is a far better practice than the use of oils in liquid form. This holds good both from the point of effectiveness and true economy.

The writers hereof neither manufacture nor deal in the commodities under consideration ; and although engaged in the manufacture and marketing of certain lubricating devices for the use of both, feel competent to argue from a purely practical standpoint and without prejudice.

Years ago numerous tests, more or less elaborate in character, were made by various eminent engineering experts to determine, if possible, the question as to whether oil or grease made the better lubricant. Those were the days of tallow compounds ; of greases made up largely of materials other than mineral oil, such as fuller's earth, soapstone, talc, resin, graphite, paraffine wax and other ingredients, used to raise the melting point and give the grease body, some of which will be found in greases of the present day. Those were the days when grease making was in its infancy ; when the art of compounding oils into a gelatinous mass called grease (properly speaking, solidified oil) in such a manner as to insure proper lubricating qualities with the maintenance of right melting points, cold tests and fire test, was as yet unknown. It is not strange, therefore, that tests made under such circumstances should, theoretically at least, present a showing more favorable to oil than to grease.

Without intending or desiring to disparage in the least the reports emanating from those learned professors as the results of their exhaustive tests, made in finely appointed laboratories and on highly sensitive machines, it may well be questioned whether, after all, they have much practical value when compared with the later experiences in the field of lubrication, in engine rooms, factories, mills and mines.

With the passing of years men have come to realize, more and more, the importance of efficient lubrication. The day has gone when any kind of cheap oil, applied in such a manner that nine-tenths of it was wasted, was considered good enough, or when a tallow grease fed in an open cup with a copper spindle to transmit heat from the journal and cause the grease to melt and run down, was thought to be the acme of perfection. With the development of machinery in mining, manufacturing and other industries, beyond anything that our forefathers ever dreamed of, has arisen a demand for better methods all along the line ; so that the "wheels of industry" might move steadily, with the least possible friction, less wear and tear and less cost. Twenty years ago the question of lubrication received scant attention, comparatively speaking; while to-day the best mechanical experts are devoting much time, thought and energy to this highly important subject and it is a very significant fact that for every barrel of lubricating grease used two decades ago there is at least a carload used at the present time and the consumption is steadily increasing. There must be good reasons for this change and they are not hard to find.

### Great Waste in Oil.

In the first place, oil used on machinery bearings cannot be properly controlled. Every engineer knows that more oil is wasted by carelessness in application, by dripping and being thrown from moving parts than is actually used as a lubricant ; he knows that dust and grit will work in where oil is used, causing greater friction and more wear on the journals, unless shut out entirely by the use of oil cellars or tight shields. These are generally inconvenient, more or less expensive, and can be applied to comparatively few places. He has learned by experience (some of it costly) that either he must feed the oil at a faster rate than the journal can use it, and put up with the large waste through dripping and spattering, the soaking of surrounding woodwork with the danger from fire, and a dirty mess generally, or else cut down the feed and be continually worried for fear the journals will run dry and make trouble ; even then there is a waste.

On the other hand, grease, rightly made and properly applied, is under perfect control. There is no dripping or spattering, consequently no need of shields or similar devices ; cleanliness is the rule rather than the exception ; dust and grit are positively excluded from the bearing, the grease working out around the collars, etc., making a perfect seal, and there is practically no wear at all on the journals. This latter statement may be disputed, but is amply substantiated by the results of careful tests made within the past two years by one of the largest railroad systems in the United States. In that case two large express locomotives, making long, hard runs every day, were selected and the driving journals boxes packed with grease. They were run twelve and fourteen months without repacking, and the report of the superintendent of motive power is to the effect that there was no wear of the journals whatever. It would be difficult, probably impossible to make a test under more severe circumstances, and it is a fact that the railroads of the United States have officially decided that grease is the proper lubricant for driving journals and crank pins. A very significant fact is that it is being applied more and more to locomotive eccentrics also. These are matters of record, and not mere statements from hearsay.

### A Good Grease.

There are greases and greases ; good, bad and indifferent. Some of the ingredients that have been and are more or less used in making them are, mineral oils, graphite, tallow, lard oil, paraffine wax, fuller's earth, soapstone, talc, resin and resin oil, horse oil, fish oil, sperm oil, palm oil, lime and lime water. Some are used to give the necessary lubricating quality to the composition ; others to produce the desired consistency, prevent rancidity, insure the grease standing certain melting point, fire and cold tests. Still others are used to cheapen the grease ; even large quantities of water being incorporated for that purpose, and certain flavors, such as oil of merbane, citronella, and others are also employed. Without entering into a discussion as to the relative value of the various articles above mentioned, or

* Manager Peterborough Lubricator Co., Peterborough, Ont.

others that are also used, it may be safely asserted that, generally speaking, the best results come from the use of greases compounded from oils alone, and any experienced grease manufacturer knows that the proper admixture of certain animal and vegetable oils with a good grade of refined, filtered mineral oil (commonly known as cylinder stock) will produce a high class grease, the quality of which will depend mainly upon the quality of the several ingredients used.

### Solidified Oil.

In the last analysis therefore, the question at issue is not so much grease vs. oil, as it is solidified oil vs. liquified oil, and present-day evidence is in favor of solidified oil.

A good grade of solidified oil will show less frictional resistance than oil applied in liquid form. The truest test is to be had by taking at random several hundred or a thousand journals running under all the different conditions of active service. Such a test is certainly more reliable in so far as the results found in everyday practice are concerned, than those made on special machines, sensitively adjusted and with the journals and bearings smoothed and polished to a high degree. Not only is it a reasonable theory that a thin film of grease constantly maintained between the metallic surfaces will result in less frictional resistance, with the wear on the grease and not on the journal, but, said theory has been proven a practical fact by the exhaustive tests hereinbefore mentioned, and many others not specifically named.

On the one hand there is grease, which is under absolute control and can be so regulated in its application and feed as to insure the least possible frictional resistance, no waste of the lubricant and no wear of the journal, all of which makes for safety, effieiency and economy. On the other hand, if oil is used, in order to be reasonably within the danger line, the rate of feed must be such that there is quite a waste of oil to avoid the possibility of actual contact between the metallic surfaces, which means great frictional resistance and actual wear. While it is not necessary to use a high-priced article, it is important that a good grease be used.

## BABBIT BEARINGS FOR HIGH SPEEDS.*

Harry H. Angus, B.A.Sc.

Until the advent of the steam turbine, high rotating speeds were seldom met with on large works, and when the turbine first came into use, the flexible shaft system of the De Laval turbine and the sleeve type of bearing used on the Parsons turbine were the only ones in common sense. It was thought at that time that babbit bearings could not be used successfully for high speeds on account of their inability to take up the vibrations caused by the rotating body being out of balance.

However, by using babbit bearings for low speeds and gradually experimenting with them at higher speeds, it has been found quite practicable at the present time to use them with speeds of 2,500 R.P.M. or more. The taking up of the vibration is no doubt due to the fact that at high speed, the journal is separated from the bearing by a film of oil which thus allows it the same motion as in the sleeve type of bearing. Success in using babbit bearing for high speed has no doubt also been due to some extent to the better facilities for balancing rotating bodies and also to the development of a special type of babbit bearings suitable for this work.

In this class of work the clearance between the bearings and the shaft should range from .002 for 1-in. shaft to .01 for 6-in. shaft and .02 for shafts 12 in. or more in diameter. If the clearance between the shaft and the bearing is too small the expansion of the shaft if the speed is raised quickly, will cause binding. In the design of bearings it is usual to keep the peripheral velocity of the journal below 75 feet per second and the pressure below 80 pounds per square inch of projected area of the bearing. Of course as the pressure is decreased, the speed may be increased or vice versa. In some recent tests with a large rotating body of 25 or 30 tons it was found that the bearing ran well with a pressure of 300 pounds per square inch and a peripheral speed of 80 feet per second, which shows that the above limits are quite low. It is usual to make the length of the bearing three times the diameter as in ordinary bearings but probably 2½ to 1 or 2 to 1 would give better results.

Formerly a great many of the larger bearings were cored out for the purpose of supplying cooling wate to the bearings. It has been found, however, that this is not necessary if the bearings are well proportioned and the oil supplied in generous quantities and well cooled before being used again. As bearings are usually enclosed in pedestals, not more than one-third of the heat generated is taken away by radiation and by air, leaving by far the greater part to be carried away by the oil. It is best in this work to have the oil flow into the bearing from a gravity system under a head of a few feet, thus insuring a very liberal supply of oil. After going through the bearing the oil is cooled and again pumped back into the gravity tank and being out of contact with the air is kept pure and can be used over again. In this way the same oil can be used for several months before an addition of new oil is necessary.

The bearing should be constructed on the ball and socket principle so as to readily take up the alignment and should also be provided with an accurate means of adjustment in any direction. If the bearings are not very carefully lined up there will be excessive vibration and heating. As there is no metallic contact in high speed bearings, the bearing metal is of small importance except that it is best to have some soft metal in order to save the shaft in case of any failure in the supply of oil. It was found by test with a 15x40-in. bearing (see Transactions of American Society of Mechanical Engineers, Vol. 27) that the thickness of the oil film varied from .0019 at 460 R.P.M. to .0032 at 1050 R.P.M. and at about 300 R.P.M. there was metallic contact of the journal with the bearing which could be noticed owing to the rapid increase of friction around this point. These tests are cited merely to show that there is no metallic contact at high speed and that for this reason the quality of the bearing metal which is so important in slow speed bearings is of little importance with high speeds. It is, however, important that the babbit metal be well fastened in the bearing and it is well to cast the babbit in the bearing then rough bore and afterwards pean well and bore true to size.

In regard to the oil grooves, the best results will be obtained by having a single oil groove along the top of the bearing parallel to the axis of the shaft. The oil is fed to the centre of this groove and runs along it and is carried around to the surfaces in contact by centrifugal action. In some classes of bearings where there is no upward thrust it is possible to do away with the greater part of the babbit in the top half of the bearing, thus allowing the oil to cool the shaft much more easily than otherwise.

Another point which it is well to look after is to see that the bearings are eased at their sides. This does away with any wedging action which may occur when the two halves of the bearing are bolted together and which is liable to cause binding, and in addition gives the oil a much better chance to do its work. The sharp edges of the bearings tend to wipe the oil from the shaft but if the bearing is eased away for about 25 degrees above and below the centre line, the oil will enter the bearing surface nearly at a tangent and is thus more easily drawn in. It will be found that the loss in bearing surface area is more than balanced by these advantages.

*Read before Toronto University Engineering Society.

# Suction Gas Producer for American Coals and Lignite

## Development and Advantages of Gas Producer Plants—Coal Tests —Description of Fairbanks-Morse Canadian Instalations, with Tests.

By L. P. TOLMAN *

The developing of power from coal and lignite is fast gaining approval among engineers and power users as the great number of instalations in Canada during the past few years signifies. The early history of producer gas dates as far back as the year 1509 in Germany, and the first plant similar to those now in use was built by Emerson Dowson in 1878 in England.

In 1899 Dr. Ludwig Mond developed the first successful soft coal producer. This became a standard for 250 h.p. and larger. Then followed inventions in Germany and France along the "suction" system, and in 1904 there were 10,000 gas producer power plants in Germany.

Comparative waste with steam and producer gas is illustrated graphically. Fig. 2 illustrates a modern steam plant with water-tube boiler and compound condensing steam engines. This plant converts 8 per cent. of the total energy of the fuel into actual work. A 150 h.p. plant of this type, running at two-thirds load, 3,100 hours per year, uses 4½ lbs. coal per b.h.p. per hour. With coal at $2.75 per ton the fuel alone costs $1,-918.12, neglecting attendance and boiler repairs.

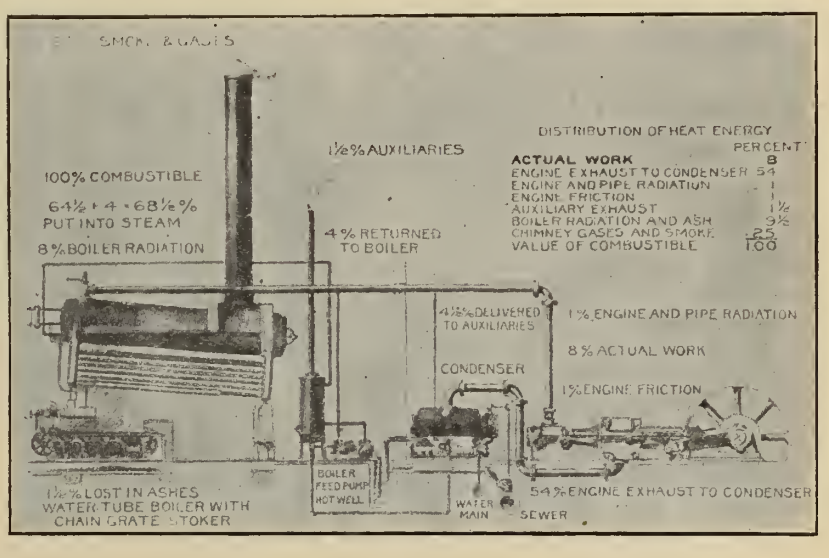



Fig. 2—Compound Condensing Steam P lant.

only 5 per cent. of the total energy of the fuel into useful work and requires 7½ lbs. of coal per b.h.p.

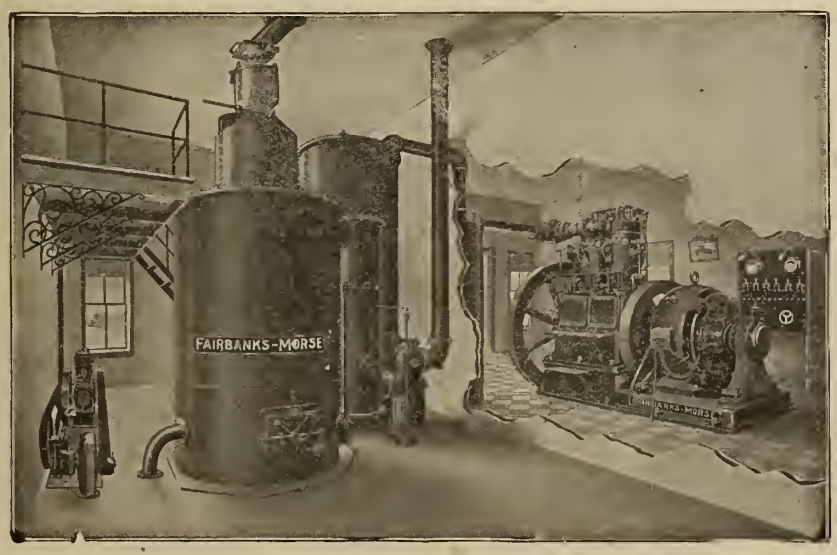



Fig. 1—Instalation in Fairbanks-Morse Factory, Toronto.

Fig. 3 is a throttling governor steam engine with tubular boiler. Coal for a

Fig. 4 illustrates a suction gas producer power plant. With this plant 18 per cent. of the total energy of the fuel is converted into useful work. This plant requires 1½ lbs. coal per b.h.p. With anthracite coal at $5 per ton, the fuel alone costs $1,162.50 per year, and the operating expense is much lower as the operator can spend part of his time at other useful work.

### Advantages of Suction Gas Producer Power.

The most practical commercial advantage is the economy effected in the cost of developing power. The producer is as simple as an ordinary heating furnace. There is no danger from explosion or fire. The operator can spend most of his time at other useful work. There is no loss by smoke and the expense of a smokestack is saved.

Fig. 5 is an exterior view and Fig. 6 a sectional view of an anthracite suction gas producer. Coal is admitted through a hopper at the top. Gas passes through vaporizer and scrubber and is then ready for use in the engine.

Anthracite is "buckwheat" or "pea" sizes, lignite, coke and charcoal are the coals commonly used. At some points in Canada these small sizes of Pennsylvania anthracite can be bought for from $3 to $4 per ton. Lignite makes a most excellent fuel for a producer and in some respects is easier to handle than anthracite.

The following tests were made at the works of Fairbanks, Morse & Co. Nos.

* Vice-president Fairbanks, Limited.

101 and 76 are from Pennsylvania and 89 from Banff, B.C.,:

| Sample No. | B.T.U. per lb. | Fxd. C. | Vol. | Ash. | Msture | Sulph. | Qual |
|---|---|---|---|---|---|---|---|
| 101 ..... ..... ..... | 13,952 | 83.5 | 5.5 | 8.2 | 2.8 | .82 | Good |
| 76 ... ..... ..... | 12.058 | 73.9 | 5.7 | 18.9 | 1.5 | .86 | Poor |
| 89 ..... ..... ..... | 14,746 | 79.3 | 8.1 | 10.5 | 2.1 | .59 | Good |

Lignite cannot be used in standard anthracite producers but in a lignite producer.

**Producer Plants in Actual Service.**

Fig. 1 is a complete producer gas power plant with engine direct connected to electric generator in the Fairbanks-Morse Works, Toronto. A 15 h.p. plant was installed in the College of Sacred Heart, Victoriaville, P.Q., with a 21 h.p. producer. The plant is operated by one of the teachers. It pumps over 2,000 gallons of water per day and lights the college at night at a cost of about forty cents per day. The coal, pea anthracite, costs $5.75 per ton. There are 150 16-c.p. lamps and a 10 k.w. Fairbanks-Morse generator is used.

In Wellington, Ont., a 65 h.p. engine with a 75 h.p. producer was installed for W. P. Niles. Pea size anthracite is used costing $4.50 per ton. During the day power is used for feed mill and at night for electric lighting. The average load is 50 h.p. The coal consumption is one pound per horse-power-hour. Thirty minutes only each morning is required to start the plant running.

A 100 h.p. engine with 100 h.p. producer is installed in the plant of Morrison Bros., Lloydminster, Sask. Bankhead anthracite is used at $6 f.o.b. Lloydminster. The engine is direct connected to a 65 k.w. Fairbanks-Morse 220-volt, direct-current generator for lighting purposes. The coal consumption is 1.3 lbs. of coal per electric horse-power hour. The engine is a two-cylinder vertical.

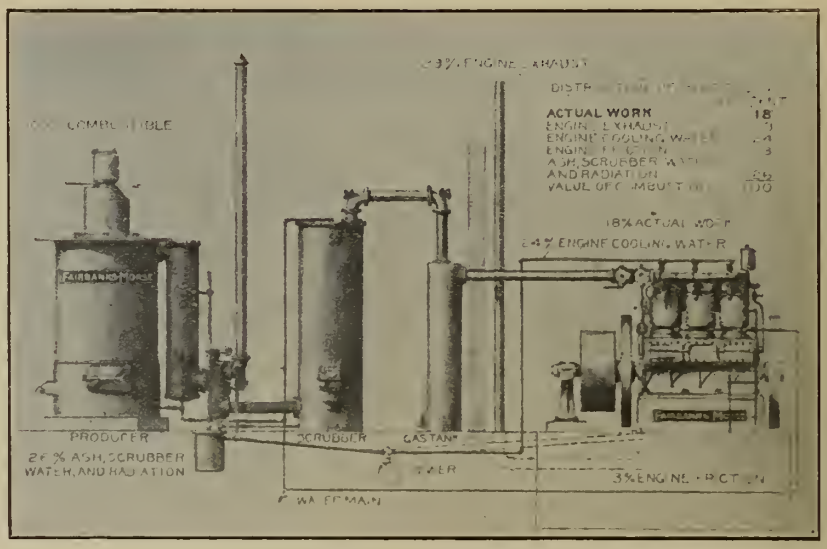



Fig. 4—Suction Gas Producer Power Plant.

When running on good gas the engine runs perfectly steady for direct electric drive. The variation in speed from full load to no load was 227 to 238 r.p.m., but this is satisfactorily compensated by the compounding of generator and only produced a momentary fluctuation at the moment of switching over. The total expense for repairs to this plant from Nov. 20th, 1907, to the present, a period of practically one year, is less than $20. The average consumption of water is about 2,000 gallons per month.

In the Fairbanks-Morse plant in Toronto two producer gas producer power plants are installed, each being 150 h.p. Lopez, Pa., semi-anthracite at $3.67 per 2,240 lbs. is used. Power is supplied to the factory, each engine being belted to two 50 k.w. Fairbanks-Morse direct-current dynamos, which run at 700 r.p.m. The voltage is 140. The two dynamos are connected to a 3-wire system so that current for power is furnished at 240 volts.

A 40 h.p. motor driving an air compressor and the motors driving the line shafting in the shop are thrown on and operated for about half an hour before the regular shop force begins. One producer man attends to the producers, elevates the coal, screens the ashes and takes the partly-burnt coal to the boiler room. where it is used for heating.

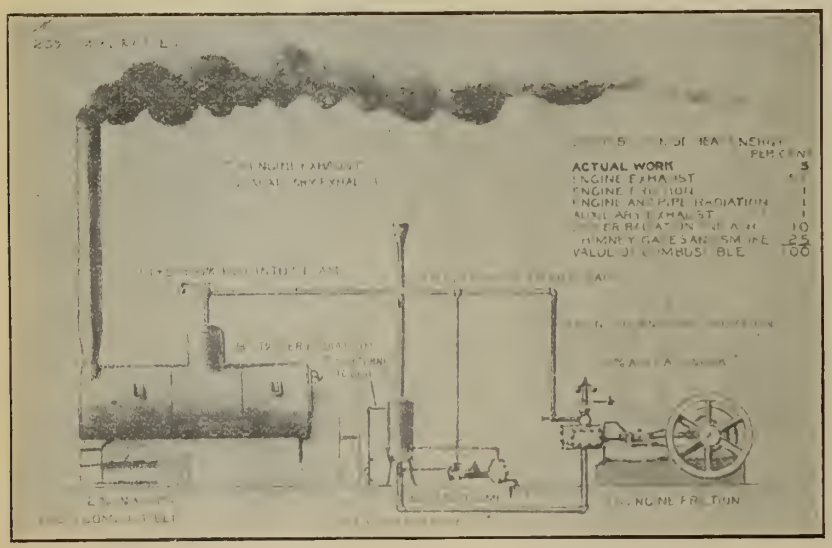



Fig. 3—Simple Steam Engine and Tubulor Boiler.

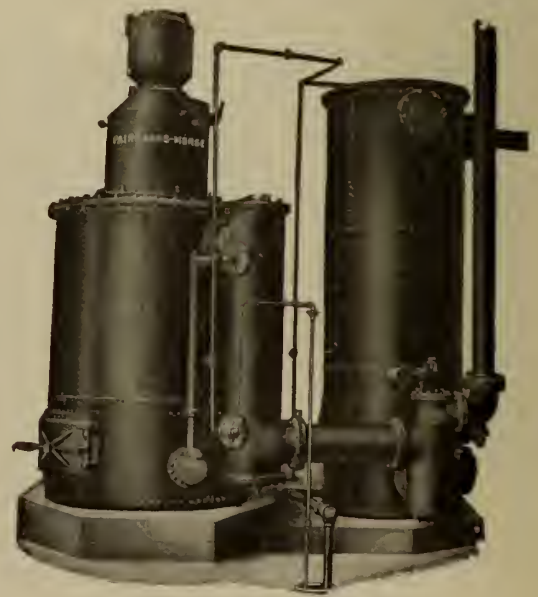


Fig. 5—Suction Gas Producer.

One engineer with a helper cares for the two engines, four dynamos, a 40 h.p. motor-driven air compressor and boiler feed pump. The total coal burned, including Saturday afternoons and Sundays, when the plant is shut down, is 41 tons, or 1 1-3 tons per day. From these instalations can be figured the economy of producer gas power plants.

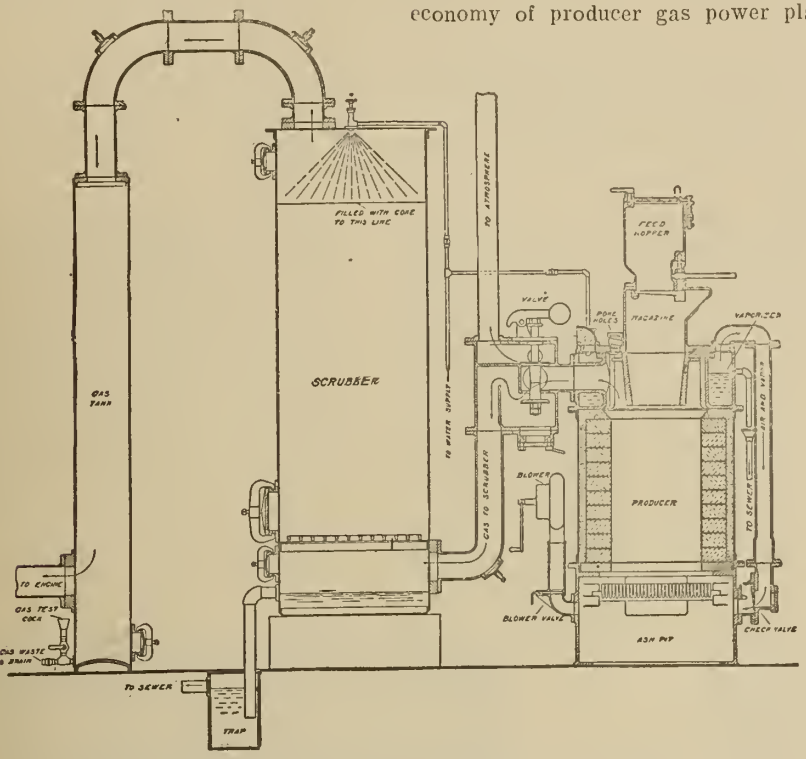



Fig. 6—Sectional View of Suctional Gas Producer.

# Welding by Oxygen with Hydrogen or Acetylene

A Process with Interesting Features from a Scientific Standpoint—
The High Heating Power Generated by Acetylene-Oxygen Gas.

By EMIL STERN

The atmosphere which surrounds us contains 76 per cent. of nitrogen and 24 per cent. of oxygen. In any ordinary flame the oxygen is used as a necessary accessory, while the nitrogen has to be carried through the process of combustion as a useless burden tending in every case to reduce the heat of the flame. So it is obvious that wherever a hot flame is required the use of pure oxygen will be of great advantage, supposing the increase of heat justifies the extra cost of buying or making pure oxygen.

For welding the application of pure oxygen as used within the last few years, has been a remarkable success, especially when used in connection with hydrogen or acetylene.

Hydrogen generally is a by-product of chemical processes, and can be bought compressed in iron tanks. Oxygen is supplied in the same form. If a large amount of oxygen is required it is better to instal a plant according to the Linde system. A new way of obtaining pure hydrogen is by filtering raw water gas through calcium-carbide. The hydrogen obtained by this process is cheaper and better than by other means. Decomposed water, two parts hydrogen and one part oxygen, cannot be used practically for welding, as there must be an excess of hydrogen to prevent the melting metal from oxydizing. For this reason electrically decomposed water cannot be used without wasting some of the oxygen, because its proportion, when decomposing, is always 2:1. The proportion advisable for welding is 1 part oxygen, with from 4 to 5 parts hydrogen.

When using compressed gases it is necessary to use reducing valves to reduce the pressure to from 7 to 30 lbs. per square inch, at which pressure the gases are conveyed to the burners by rubber tubing, where they are thoroughly mixed. The gases enter the burner at a sharp angle, entering first a small mixing chamber. On account of the high pressure the excess of hydrogen and a small nozzle being used to increase the speed of the gases, the flame will not fire back. The mixture 4.1 generates a temperature of 3400 degrees F. (1900 centigrade), which will melt any metal. Sheet iron may be welded by hydrogen in sizes up to 3/8-inch. For thicker sheets the cost does not permit of using this process economically. On the other hand, very thin sheets require great care and skill as they melt and get holes very rapidly. A clever welder can weld sheets as thin as 1-132-inch.

The temperature of the flame depends largely on the quality of the oxygen. Commercial oxygen, as a rule, does not contain more than 96 per cent. of pure oxygen, the balance being nitrogen. The purer the oxygen the higher the flame temperature; the more nitrogen mixed with the oxygen, the lower the temperature. It might be possible by purposely diluting the oxygen to obtain a temperature which permits of welding safely very thin sheets. This would be important for many industries, for instance, in the manufacture of graniteware.

Since last year a new system has been applied for welding, which uses a mixture of acetylene and oxygen. Ten years ago trials were made to use acetylene for obtaining high temperatures. The results were not favorable, because the burners used did not fill the requirements caused by the inflammability and high contents of carbon in the acetylene.

### A New Burner Invented.

Lately the Frenchman, Fouche, invented a burner which mixes the two gases thoroughly and does not allow the flame to fire back nor the carbon to deposit.

For the use in this burner the acetylene does not require more than 2 inches of water pressure (about 1 oz. per square inch).

Any portable acetylene apparatus can be used to make the gas. A purifier is required to retain phosphor or arsen, as acetylene has to be as pure as possible for welding purposes.

The oxygen is forced to the burner at from 15 to 30 lbs. pressure through a small nozzle injecting and thoroughly mixing with the acetylene. The mixture must leave the burner at a speed of over 1,000 ft. per second, so as not to allow the flame to fire back. Like with the use of hydrogen an excess of acetylene is required, 1 cubic foot of acetylene requires 2.5 cubic feet of oxygen for complete combustion. In fact, there is only 1.7 cubic feet of oxygen added to 1 cubic foot of acetylene.

One cubic foot of acetylene contains much more heat than the same amount of hydrogen.

### Great Heat of Acetylene-Oxygen.

1 cubic foot of acetylene gas contains 1,550 B.t.u.

1 cubic foot of hydrogen gas contains 342 B.t.u.

1 cubic foot of acetylene-oxygen mixture contains 575 B.t.u.

1 cubic foot of hydrogen-oxygen mixture contains 274 B.t.u.

The calculated flame temperature of the acetylene-oxygen flame is 7,800 degrees F. The actual flame temperature is far below this point, probably around 5,500 degrees F.

The litle blue acetylene-oxygen flame will melt anything, iron, carbide, brick and fireclay, graphite only will not melt. The high temperature of the acetylene-oxygen flame permits of welding large pieces, little heat being radiated until the welding temperature is reached.

A hydrogen welding seam looks distinctly different from an acetylene welding seam, the hydrogen tempering strip being about 2 inches wide, the acetylene tempering strip being less than 1 inch wide. This accounts partly for the cheapness of the acetylene process compared to the hydrogen process.

The price of welding per foot depends on the size of the material and the skill of the welder.

Manufacturers interested in the sale of the welding apparatus estimate the cost of welding 1 foot as in the accompanying table:

Cost of welding 1 foot of sheet iron.

| Thickness of sheet | Hydrogen welding. Cost of hydrogen and oxygen f.o.b. Toronto. | Hydrogen welding. Welders' wages at 40c. an hour. | Hydrogen welding. Total. | Acetylene welding. Cost of acetylene and oxygen f.o.b. Toronto. | Acetylene welding. Welders' wages at 40c. an hour. | Acetylene welding. Total. | Total, including capital charges for instalation. |
|---|---|---|---|---|---|---|---|
| Inch. | c. | c. | c. | c. | c. | c. | c. |
| 1-64 | .5 | 1 | 1.5 | .. | .. | .. | .. |
| 1-32 | 1 | 1.2 | 2.2 | .3 | 1 | 1.3 | 1.5 |
| 1-16 | 2 | 2 | 4 | .8 | 1.5 | 2.3 | 2.5 |
| 1-8 | 7 | 3.5 | 10.5 | 2.5 | 2.2 | 4.7 | 5.2 |
| 3-16 | 16 | 5 | 21 | 5 | 3 | 8 | 9 |
| 1.4 | 30 | 6 | 36 | 10 | 4 | 14 | 16 |
| 3-8 | 50 | 8 | 58 | 20 | 5 | 25 | 28 |

These figures are much too low for practical use, especially when used outside the shop the cost may safely be figured to be three times as high. For safe calculation, not only material and wages, but interest and depreciation must be figured as well.

The hydrogen instalation is the cheaper one, its price being about $100. Acetylene plants are about $200—up to 3-16 inch, about $300—up to ¼ inch.

Large plants up to 1¼ inches capacity with 5 Fouche burners, cost about $1,000.

The stability of the welding seam is of special importance. Evidently it depends largely on the quality of the hydrogen or acetylene. Above all, the gases have to be free from arsen and phosphor which two elements are known to make iron brittle. The skill of the welder is another important item. The material which is melted in the welding, also effects the stability. Consequently the stability of the welding does not entirely depend on the stability of the iron to be welded. Various tests have been made. Tough sheet iron—Swedish charcoal iron—gave the best results. The welding seam was in every case stronger than the original piece, which would always tear before the seam would tear.

Steel wire did not weld satisfactorily at all; the welding seam was brittle, the stability only amounting to 75 per cent. of the original piece. Practice shows that the stability is not reduced if skill and care is used.

It depends on the purpose for which it is used whether hydrogen or acetylene welding plant should be installed. The hydrogen plant is preferable for occasional use, for thin sheets, for repairing and for metals that melt easily. The apparatus is simpler, easier to operate and easier to move, there is less danger and the success is safer than with the acetylene plant. On the other hand acetylene permits of welding heavier pieces, and it will be cheaper in the end when in steady use, though the first cost is much higher. It is not so suitable for repair work and for moving. In a large shop long pipes will be required. No license is required for the instalation. The acetylene plant is especially suited for welding cast iron. In one instance the flange of an automobile cylinder was broken and repaired under guarantee for $35. A new cylinder would have cost $150.

Fig. 1—Tank Being Filled.

Fig. 2—Motor Running Under Water.

## WELLAND CANAL ELECTRICAL EQUIPMENT.

The latest and one of the most important improvements in the electrification of the Welland Canal, is the instalation of lock opening and closing mechanisms, which are operated by induction motors. The motors are directly geared to the mechanisms which operate through a friction clutch, the whole being housed in galvanized iron boxes or covers at each lock. The attendant throws in the reverse or forward switch for opening or closing, special switches being provided which extend outside the housing within easy access of the attendant.

The old method of opening by manual labor required about six minutes for each pair of lock gates, while with the new mechanisms operated by induction motors, the time taken is only 35 to 40 seconds.

There were required for this work over one hundred 5-horse-power motors, supplied by the Packard Electric Co., Limited, St. Catharines. The motors are of the squirrel cage type, 220 volts, three-phase, 1,200-revolutions, with special shaft for gearing to mechanism.

Special attention was given to the matter of insulation, the coils being thoroughly impregnated by the vacuum process, after being placed in position in the slots, rendering them impervious to moisture.

# Some Things a Manufacturer Should Know About Coal*

## A Supply of Coal of Proper Character to Suit the Conditions in His Particular Plant and Give the Greatest Efficiency Must be Obtained.

By E. G. BAILEY

The majority of manufacturers are dependent upon the combustion of coal for the operation of their mill. The man who is responsible for the continuous and economic operation of the plant should know : (a) Where he can always get coal when he needs it. (b)Where he can get coal of such character and quality that his plant will not be crippled for lack of steam. (c) What coal is the most economical for him to burn. (d) How to convert a large percentage of the heat energy of the coal into useful work.

(a) It is an exceptional circumstance when a manufacturer does not have many kinds of coal offered him at competitive prices. But at times of strikes or delays in transportation he is sometimes compelled to seek coal and pay whatever price is asked. In placing a contract this point should be kept in mind and whenever the difference in price is not too great, preference should be given to the company that is most able to keep you supplied with coal at such exceptional times. If you expect fair treatment from the coal company you must treat it fairly by living up to your part of the contract whether the price falls or rises during the continuance of the contract.

When plants are at any great distance from the mines it becomes necessary to store a considerable quantity of coal. This involves additional expense due to the extra handling, value of storage space, and loss of coal both mechanically and chemically. The loss due to oxidation or weathering of coal not only reduces the calorific value of the coal, but as the temperature of the pile rises, the oxidation becomes more rapid until the ignition temperature is reached and much additional labor and expense is necessary to prevent the burning of the coal and often the destruction of other property. There are many theories as to the cause of spontaneous combustion in coal piles and several remedies have been tried with more or less success. Storing coal under water seems to be the only method of absolute prevention. Sulphur is generally referred to as the cause of spontaneous combustion, but each per cent. of sulphur if burned completely and no heat was radiated from the pile during the slow combustion, would raise the temperature of the pile only 200 degrees Fahrenheit. Many cases of spontaneous combustion occur in piles of coal that contain less than one per cent. of sulphur, and analyses of coal from heated piles show that only a small percentage of the sulphur has been oxidized. Some heat must be radiated from the pile and a temperature considerably above 200 degrees Fahrenheit, is necessarily reached. Should the sulphur exist in the form of pyrites and both the iron and sulphur oxidize, the heat generated would not be great enough to cause the temperature of the pile to rise as high as 550 to 600 degrees, which temperatures have been reached before the coal really ignited. Excessive moisture may play some part in causing spontaneous combustion, but exceptions to this are many. The height to which the coal is piled is generally considered a very important factor, but frequently the hottest part of a pile 20 feet deep is within three feet of the surface. In one case a pile of coal ten feet deep took fire about six feet below the surface and in another part of the same pile the coal was 35 feet deep with no signs whatever of heating. Some coals store better than others, the reasons for which seems to depend upon its physical structure rather than the chemical composition.

It seems that the rate of circulation of air through a coal pile has more to do with this question than any other condition outside of the character of the coal. The heating is mostly very irregular throughout a pile, as there are usually spots where the temperature is much higher than in the surrounding space. For this reason the usual method of taking temperature measurements in a pile by letting a thermometer down a set of pipes scattered throughout the pile is very unsatisfactory as the hottest spot that will soon cause trouble may be missed entirely. The question, what is the safety limit for the temperature of a coal pile, is frequently asked, and it is rather difficult to answer for a coal pile may heat up to a pretty high degree, then cool down without being moved. But if there is enough heat generated to raise the temperature of the coal pile to 212 degrees Fahrenheit, the moisture being evaporated at or before this temperature is reached leaves only the dry coal, which has a comparatively low specific heat, to be heated. The heating takes place much faster and the rate of oxidation also increases with the rise in temperature. The carbon in the coal evidently oxidizes to a considerable extent as large percentages of carbon dioxide have been found in coal piles at comparatively low temperatures.

(b) Many plants are so limited in boiler capacity, have such poor draft, or some kind of grate or stoker that it is possible for their boiler room force to keep steam with only certain kinds of coal. While this is not an ideal state of affairs it is a condition that exists in a large percentage of the power plants in this country and unless a man knows what coal will develop the required boiler horse-power in his plant he may have the costly experience of shutting down a part or all of his mill. There is a great deal of difference in the rate of combustion of different coals. The percentage of volatile matter, coking properties, amount and nature of ash are the principal factors upon which depends this characteristic in various coals. It is not always the better or higher priced coals that give the best satisfaction under such conditions, for a cheaper coal might give more satisfactory results than are being obtained with the highest priced coals on the market, but the risk of experimenting has seemed too great for the management to consider stepping out of the well beaten path.

### The Most Economical Coal.

(c) All minerals or raw material are bought because they contain some one ingredient or property that may by a certain treatment or operation be enhanced in value or utilized by the manufacturer in such a way as to cause him to make a profit from the principal product of his factory. It is seldom that any mineral or raw material does not contain some impurity or inert matter that may involve additional expense for its riddance or by a certain process may be converted into a by-product and thus become a secondary source of profit. Coal varies more in character and quality than any other mineral produced. In character it is found in all successive stages between lignite and anthracite. Each different kind is more applicable

* Paper read before National Association of Cotton Manufacturers.

for one purpose than another. In selecting a coal for making illuminating gas the yield of gas measured in "candle feet" is of primary importance, while the coke and tar are by-products, and sulphur is the impurity that causes additional expense. For making coke the purity, structure and yield of coke are the properties to be considered, and the gas, tar and ammonia may be utilized as by-products. In buying steam coal the amount of heat that may be developed from it is the measure of its value to you. There is no by-product that may be utilized, except that in some cases the sale of ashes might be considered in this connection, but their removal is generally an additional expense. Two coals at the same price and containing the same number of heat units may not be equally desirable. The difference in volatile matter might cause the lower to prove more satisfactory under certain conditions of smoke restriction, while the higher volatile coal would probably be more applicable in a plant with fluctuating load. The amount and nature of ash in regard to the formation of clinker often needs to be considered.

The liability of spontaneous combustion of one coal more than another may make it advisable to pay several cents per ton more for one coal containing no more heat units than the other.

The following table shows the analyses and results of evaporative tests of some of the better coals together with their price f.o.b. cars at the plant of an inland mill. The relative values have been calculated by taking coal A as a basis and determining what will be the cost of the equivalent amount of coal required to produce the same number of heat units as coal A produces for $4.60 per ton. For example, should you buy coal F at $4.40 per ton your coal bill would amount to the same as if you had bought coal A and paid $4.92 per ton for it, but as you can get coal A for $4.60 you would save 32 cents per ton by taking coal A instead of coal F at the given prices.

| Coal | Moisture | Volatile | Fixed carbon | Ash | Sulphur | B. t. u. | Lbs. water evaporated from and at 212 deg. F. | Price f.o.b. plant | Relative cost per ton with Coal A as basis. By B. t. u. | Relative cost per ton with Coal A as basis. By evaporation |
|---|---|---|---|---|---|---|---|---|---|---|
| A ... ..... | 1.25 | 17.94 | 73.15 | 7.66 | 2.07 | 14354 | 9.93 | $4.60 | $4.60 | $4.60 |
| B ... ..... | 1.43 | 17.59 | 71.58 | 9.40 | 1.09 | 14032 | 9.73 | 4.55 | 4.65 | 4.64 |
| C ... ..... | 1.17 | 30.51 | 61.01 | 7.31 | 0.99 | 14251 | 9.79 | 4.65 | 4.69 | 4.71 |
| D ... ..... | 1.36 | 16.42 | 71.35 | 10.87 | 1.77 | 13811 | 9.60 | 4.58 | 4.76 | 4.74 |
| E ... ..... | 1.75 | 19.58 | 71.95 | 6.72 | 0.82 | 14533 | 10.03 | 4.86 | 4.80 | 4.79 |
| F ... ..... | 3.72 | 21.06 | 66.90 | 8.32 | 1.36 | 12834 | 8.80 | 4.40 | 4.92 | 4.96 |
| G ... ..... | 1.74 | 31.16 | 53.68 | 13.42 | 2.93 | 12833 | 8.67 | 4.60 | 5.14 | 5.27 |

In this case it appears that neither the best nor the lowest priced coal would be the cheapest to buy.

In this table the coals are arranged in order of cost for equal amounts of heat generated and equal evaporation, but in selecting a coal for any particular plant it might be policy to select a coal that would cost a little more money in order to obtain some particular advantage that a certain coal might have over another. Comparing coals A and B, coal A appears to be better in every way except that it contains about one per cent. more sulphur than does B. For steam purposes the sulphur is of little importance below two per cent, at least, so that coal A would probably be selected on account of its being five cents per ton cheaper on a heat unit basis and there would also be less ash to handle. In case a plant had limited draft and boiler capacity a coal like C might be selected in preference to B or even A with a difference of nine cents per ton in favor of coal A. Should the prevention of smoke be an item of considerable importance coal D would probably be purchased at an additional expense of seven cents per ton as compared with coal C. Of the two coals D and E there is a difference of only four cents per ton, and that would scarcely pay for the additional cost of handling the ashes, the possibility of not being able to carry the load without the use of more boilers and other expenses that are greater with a poorer coal.

While coal E is the best all round coal it would not pay to purchase it when coal A could be obtained for 20 cents per ton cheaper on a heat unit basis, and 19 cents per ton cheaper on an evaporation basis.

Coals F and G are both much inferior to the others and their purchase would not be considered when any of the other coals were available at the given prices. Judging from the ash and sulphur alone it would seem that coal F would be better than either B or D, but a certain characteristic appears in this coal that makes it different from any of the others. It is "crop" or "red" coal coming from a part of the seam near the outcrop has become saturated with the surface water that has been percolating through it for hundreds of years. The moisture is much higher than in any of the other coals and it contains a still larger percentage of combined water that is not driven off by the mere drying of the coal. If a man were depending upon the ash determination alone he would never detect that he was receiving an inferior quality of coal; in comparison with coal A he would be paying 20 cents per ton less for the coal yet he would have to burn so much more of it to develop the same horse-power that he would actually be losing 32 cents per ton or $16,000 per year on a 50,000-ton contract.

Coal G is high in ash and sulphur and correspondingly low in B.t.u., so that it would be a very expensive fuel to burn at the price quoted, and in comparison with the other coal you would not consider it. Yet there are thousands of tons of it being burned and the manufacturer seems to be willing to pay the price.

In the preceding table the equivalent evaporation in pounds of water from and at 212 degrees Fahrenheit is given as determined in carefully conducted boiler tests on the same boiler. They represent the average of two or more tests under as nearly identical conditions as it is possible to maintain, thus accounting for the closeness of their comparison with the B.t.u. determination. Duplicate boiler tests on the same coal frequently vary five to ten per cent., even though the method of firing and the rate of combustion have changed as little as possible. The chemical analysis and calorimetric determination will represent the value of coal within one per cent. providing the samples are properly taken. The plea for evaporative tests because they are practical is counterbalanced by their failure to burn the coal under equally comparable conditions in two or more cases. A fireman must become accustomed to different coals and find wherein they must be handled differently in the firebox in order to obtain the best evaporation from each. The laboratory tests are generally considered as theoretical and unreliable. But theory and practice always agree when they both represent the facts.

After the most economical coal has been selected, it remains for the manufacturer to see that such coal is delivered. Throughout the year the coal company may send coal of different quality from other mines, or the quality of the coal from the same mine may change, due to impurities encountered in the seam or lack of preparation at the mine. The coal operator may know of the change in quality as many of them follow up their product by chemical analysis and inspection much more closely than does the purchaser, but it is the manufacturer's place to know what he is getting and prove to the

coal company that the coal has changed and that he is not receiving the coal he is entitled to by contract. The results of an evaporative test mean but little to anyone except the man who conducts them, and apply only to the one plant and set of conditions under which they were made, while the analysis of coal is now on such a standard basis that the results are comparable whether the sample is taken at the mines, en route, or at the destination. There are many analyses published and given out by a large number of coal companies that represent selected samples of the coal from certain parts of the seam that are absolutely valueless as representing the quality of coal actually loaded at their tipple. Such a policy is short-sighted and is fortunately disappearing, for the consumer is going to find out for himself when the coal reaches his plant, and the comparison of results is generally to the discredit of the coal company. But the person who has suffered the most from this practice is the coal man who does give representative figures, for he is judged by the consumer as also giving fancy results and allowance is wrongly made for shrinkage. The present-day tendency is to buy coal on a B.t.u. basis, adjusting the price for the coal delivered in accordance with its quality. The advisability of carrying this into effect depends upon the tonnage, method of delivery, and difficulty in otherwise obtaining a uniform product. The fact that a coal company knows their coal is being systematically analyzed is generally sufficient to ensure the delivery of coal of uniform quality.

### To Get the Greatest Efficiency.

In addition to knowing what is the most economical coal to buy, the manufacturer must know :—

(d) How to convert a large percentage of the heat energy of the coal into useful work. The efficiency of a boiler plant depends primarily upon the completeness of combustion of the fuel and completeness of absorption of the generated heat by the water or steam in the economizer, boiler or superheater. It is impossible to generate into available form all of the heat energy of the coal. Some coal and carbon are lost with the ashes, while combustible gases and carbon in the form of smoke usually escape unburned to a greater or less extent. The loss due to incomplete combustion depends largely upon the design of the grate, furnace, and combustion chamber, as well as the proportionate rate and method of supplying coal and air to the furnace.

There are so many kinds of mechanical stokers, special furnace designs, fuel-saving devices and smoke preventers on the market that the manufacturer is at a loss to know which one would give the best results in his plant or whether it would pay at all to change from the old hand-fired stationary grate. Many people instal a certain appliance because it has given satisfaction in some plant known to them. They do not stop to consider that their conditions may be different, they may have a more fluctuating load, it may not do equally well with the coal they want to burn, or they may not have men of the necessary intelligence or experience in their boiler room to successfully operate the appliance. A mechanical stoker that does very satisfactory work when one kind of coal is being burned may fail when fed with another coal. The fault does not lie in the stoker but in the judgment of the man who tried to burn a certain coal on it under certain conditions. A man, hand-firing a stationary grate also frequently fails to keep steam with one coal when he could with another. It may or may not be the fault of the fireman, but such difficulty is usually due to his unfamiliarity with the coal, and he tries to fire it in the same manner he has been accustomed to firing the coal he has previously used. If two firemen, one having always burned a good coal that formed practically no clinker, and the other a coal which clinkered badly, should both receive the same kind of coal of medium quality, one might fail to keep steam and the other would consider that it was of very good quality. In many cases it would pay to make changes in the boiler plant or add more boilers so that the most economical coal could be burned regardless of its quality, as well as to secure as nearly complete combustion as possible.

### Air Regulation.

The question of smoke prevention must receive more consideration from the manufacturer in the future than it has in the past. While it may not be possible or economical to prevent the last traces of smoke, yet there are many stacks in different parts of the country that issue so little smoke that they are not at all objectionable. In most cases where other than anthracite coal is being burned the prevention of smoke has been accomplished by means of furnace design and the method of firing.

After combustion has taken place the heat of the coal appears in the form of sensible heat in the gases leaving the furnace or combustion chamber. The important problem is to cool the gases as much as possible with a minimum of boiler heating surface. In order to accomplish this the heating surface should be kept clean inside and out. Too much emphasis cannot be put on this point. Combustion is more complete with considerable excess air, but this excess air passing through the furnace reduces the temperature of the gases approaching the boiler and the temperature of the escaping gases remains about the same so that a larger percentage of the developed heat is lost up the stack. This condition might be compared with a steam engine running with low initial pressure and exhausting against a high back pressure. The amount of air excess is regulated by the intensity of draft and condition of the bed of fuel. Few firemen have ever had the opportunity of learning what was the best thickness of fire or intensity of draft under the conditions existing in their boiler plant when burning a certain kind of coal. Many people think the stronger the draft the better, but there is opportunity to save thousands of dollars every year in may plants by merely reducing the draft or better regulation of it. The instalation of a damper regulator is not always the remedy for they often cause more loss than occurred when hand-regulated dampers were used.

The analysis of the flue gases is the best criterion for regulating the conditions of a furnace so as to obtain nearly complete combustion with a minimum of air excess. The perfecting of automatic gas indicators and recorders will do very much toward increasing the boiler room efficiency.

No one kind of boilers or heat absorbing apparatus will give equal satisfaction in all plants. This depends upon location of plant, kind of water, uniformity of load, kind of coal, etc., and must be determined in each individual case.

It may seem unnecessary to investigate so thoroughly what would be the most economical fuel, how it can best be burned, and how the largest percentage of the heat can be converted into useful work, but the money saved by doing so, even in the smaller plants, amounts to a surprising sum in the course of a year. The manufacturer who is too busy enlarging his mill and increasing his output to give corresponding attention to his boiler room usually regrets the mistake when all his labor is standing idle for lack of power or the coal bill becomes a disproportional percentage of his cost of operation.

---

George Anderson & Co. and Gricc's Gas Engine Co., Carnoustie, Scotland, with American headquarters at 420 Ogden St., Newark, N.J., have opened up a branch office at 157 Craig St., Montreal. They are represented here by M. Haas. George Anderson & Co. manufacture stone sawing machines, the diamond blades for which will be manufactured in Montreal. Gricc's Gas Engine Co. are manufacturers of the Gricc's gas engine and suction gas plants.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

### A TALK WITH OUR READERS.

Each month we intend giving a number of practical articles of use to engineers. The October issue has a number of pages of these and we are on the lookout for more of this material.

Have you any special methods or devices that you find useful in the engine or boiler room ? If you have, write to us about it in your own words. Illustrate, if possible. The sketch may be rough, but we will attend to that. If your article is acceptable we will arrange it for publication and pay you liberally for it.

The only stipulation is that the article must give a useful idea. It may be an old device that you have not thought worth writing about before, but it may be just the thing another engineer or fireman is looking for. Address, The Power House, 10 Front St. East, Toronto, and it will reach the editor.

---

### POWER FACTOR PROBLEM*.

By H. W. Price, B.A.Sc.

Problem.—A question which may be of interest was submitted to the writer a few weeks ago. A manufacturer was using induction motors to operate a large factory, and found the average load to be 200 kilowatts at 60 per cent. power factor. To improve the power factor, it was proposed to install a synchronous motor of probably 75 horse-power to be used as a motor and as a "synchronous condenser." Question : "What will the power factor be if that motor is installed ?"

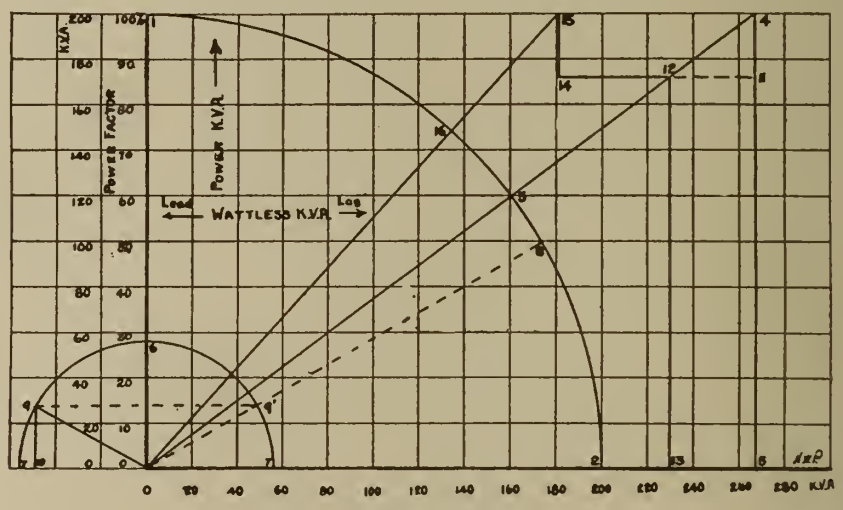
The information being incomplete, it was ascertained further that 200 kilowatts would supply every requirement and induction motors would be removed in so far as the synchronous motor could replace them.

Solution.—The problem is solved graphically. See figure. On a sheet of section paper choose point. 0. From it draw vertically a line 100 parts long, and describe the quadrant 1, 2. The quadrant will serve very conveniently for reading power factors when supplemented by a vertical scale of power factor as indicated. The direction 0, 1 will serve to represent power input to the plant on a scale as marked, while direction 0, 2 may represent wattless input due to power factors less than 100 per cent.

The power input is 200 k.w. at 60 per cent. power factor. To find the power and wattless components of the load, locate the 60 per cent. line which intersects the quadrant at 3. From 0 draw 0, 3 produced to intersect the 200 k.w. line at 4. Then 0, 4 represents the k.v.a. (kilovolt-ampere) input to the induction motors, of which the energy component is 5, 4 equals 200 k.w. and the wattless component is 0, 5, equals 267 k.v.a. The synchronous motor is desired to reduce the objectionably large wattless lagging component by neutralizing it so far as possible by wattless leading component.

The rated capacity of the proposed motor is 75 h.p. or 55 k.w. From 0 at radius 0, 6, equals 56 k.w. draw the semi-circle 7, 6, 7, which is the locus of the rated k.v.a. capacity of the motor. If the motor were operated at 100 per cent. of its rated current capacity. The 50 per cent. power factor line locates point 8, hence points 9' and 9 on the capacity circle of the motor. Then with over-excited field 0, 9 is the k.v.a. input to the motor, of which 10, 9 is the power input and 0, 10 the wattless k.v.a. input due to leading currents caused by the suitably over-excited field.

The induction motor load 5, 4 equal 200 k.w. may now be reduced by 4, 11 equals 9, 10 equals 28 k.w. to be carried by the synchronous motor, that is 28 k.w. or 37½ h.p. of induction motors may be removed. Since these motors operate at 60 per cent. power factor, their removal reduces the wattless k.v.a. input by 11, 12, leaving 13, 12 equals 172 k.w. load for induction motors at 60 per cent. power factor. The wattless lagging input 0, 13 of these motors will be reduced by the wattless leading input 0, 10 equals 12, 14 to the synchronous motor, and the latter will




Power Factor Problem.

cent. power factor, it would be capable of delivering 56 k.w. continuously without overheating. If its field were over-excited so as to cause the receipt of leading currents, the load would of necessity be reduced to avoid overheating so that the input k.v.a. could not exceed 56 k.v.a. Since the reason for the change in machines is necessity of wattless leading currents to neutralize lagging currents, it is desirable to operate the synchronous motor at fairly low power factor, say 50 per cent. This value permits the motor to deliver one-half its rated output and also take leading currents to the extent of 87 per deliver power to the extent 14, 15 equals 10, 9.

Hence the new motor, if operated at full load current at 50 per cent. power factor with over-excited field, will reduce the total k.v.a. input from 0, 4 to 0, 15 for the same load, 200 k.w., and raise the power factor as shown by intersection at point 16, to 74 per cent.

---

### SOUVENIR FOR ENGINEERS.

The Canada Metal Co., Ltd., Toronto, are giving away a keyring which every engineer and superintendent will find a very acceptable and useful souvenir.

* Read before the University of Toronto Engineering Society.

## REPAIRING A DUPLEX STEAM PUMP.

By John Furlow.

Last January I installed a duplex steam boiler feed pump in the steam plant of a planing mill. The pump was a second-hand one and as I had only Sunday to install it I did not get time to examine or overhaul it.

I was absent for two weeks shortly after this and when I returned to the plant I noticed that the pump traveled rather fast for the amount of water required and after shutting down at six o'clock, my fireman and I proceeded to examine the pump. We found it fitted with soft rubber, cold water, valves, which were in a very bad shape.

I took the size and ordered a set from a local dealer. He did not have them in stock, but said he was going to Toronto next day and would bring them back with him. He returned without them, saying that a set would have to be made.

Next day the pump refused to throw water into the boiler. We removed the valves and faced them off so that they again worked. Three days after, however, the pump again showed signs of trouble. We were busy and shutting down was out of the question. I had to do a little quick thinking and act immediately. I decided to try a hardwood set. I took the size over to the woodshop and had a set of oak ones made. Then with a set of wrenches and other necessaries ready, I stopped the pump and made the change. We had no further trouble with the pump. The wooden valves worked all right until the new hard rubber ones came a week later.

## TILING FOR ENGINE ROOM.

By R. Mills.

A manufacturer takes considerable pride in the appearance of his plant. The engine room is a part of a plant which can be made to have a more handsome appearance than any other part. The engineer takes particular pride in his power plant, and it's a poor kind of an engineer who does not keep his engines, electrical machinery and engine room fittings well polished and bright looking.

An important feature in engine room appearance is the style of walls and flooring. Glazed brick or tiling is not generally used as a covering for the walls and floors of the engine room, but its advantages are numerous, and should be realized by those having to do with the building and fitting of engine rooms.

Tiling properly set in hard cement is durable, fireproof, non-absorbent and easy to keep clean and neat looking. With particular reference to the engine room, one of the specific values of tiling the floors and walls is that it cannot absorb the lubricating oil, grease and other similar materials that are necessarily dropped upon the floor, or spattered upon the walls by the revolving crank shafts. Wood of course readily absorbs this oil or grease which causes it to emit a more or less disagreeable odor, and, furthermore, renders it highly inflammable.

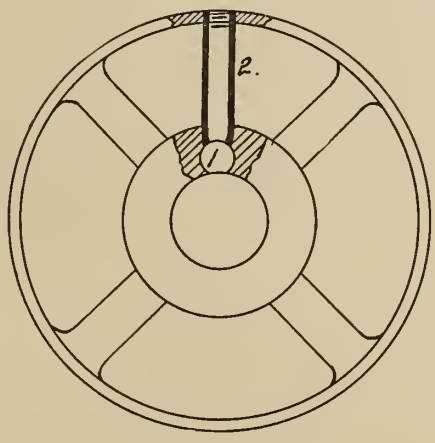
Thus besides the decorative and artistic properties of tiling, there are other more valuable features from the commercial and economic point of view.

## OILING LOOSE PULLEYS.

By L. Bailey, Hamilton.

Under the head of Tricks of the Trade I would like to say for the benefit of those who may have had some trouble with loose pulleys that I have had a lot of difficulty with loose pulleys that run at a high speed in getting the oil to stay in and oil the shaft properly, but at last I struck a scheme that has proved to be just the thing, and a glance at the accompanying sketch will explain the trick.

It will be seen at Fig. 1 is a hole drilled right through the hub of the pulley, and Fig. 2 is a piece of ¼-inch brass tube with a grub screw in the outer end to keep the oil from coming out. The hole that is drilled in the hub just breaks through into the pulley bore and

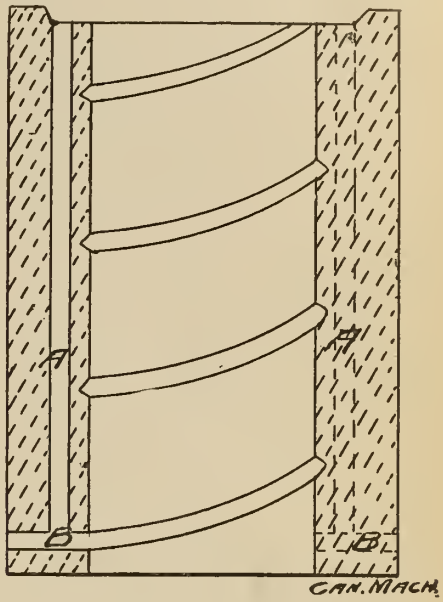



Oiling Loose Pulley.

a piece of candle wick pulled through the hole absorbs the oil that is put into the brass tube. And so the wick coming in contact with the shaft keeps a perfect lubrication on the same.

## OILING DEVICE FOR VERTICAL BEARING.

On some special machinery which the Otto-Higel Co., Ltd., Toronto, makers of piano keys and actions, have in their machine shop, is employed an automatic oiling device for high speed vertical bearings which has given excellent satisfaction. It is also used on cream separators with good results. The accompanying illustration is of a bushing containing this device. As show A there are two or more blind holes drilled in the bushing; at B a hole is drilled as shown, and from this hole a thread with a large pitch is cut on the inside




Oil Device for Vertical Bearings.

of the bushing. If the spindle runs in the right hand direction this will be a left hand thread or vice versa. The oil is held on the top of the bushing around the shaft and runs down the two or more holes and out to the spiral groove or thread. The centrifugal force causes the oil to travel to the top of the bushing through this groove. Thus a continual circulation of oil is maintained.

## LOCATING CAUSES OF TROUBLES.

By G. H. Shutcliff.

Sometimes engineers and firemen have difficulty in locating causes of trouble in their engine, pumps or piping. Even the most experienced man sometimes fails to find the cause and only the greatest care in going over every part of the engine or pump reveals it. Perhaps the following will be of use to some engineer or fireman who may sometimes find that his engine or pump will not work. Troubles try the patience and absorb a great deal of time.

One company with which I worked bought a boiler feed pump, instaling it in the usual manner, but when the steam was turned on it refused to work. Two experienced men spent a week on it, valves and packings were examined, but it would not work. It was taken apart and put together again, but to no avail. I was asked to look at it, but could see nothing wrong with the main working parts. A new pump was about to be ordered, when I thought of the auto-

matic valve, which so far had been overlooked. I found that a small piece of packing had filled up the small port and the valve wouldn't work. A piece of wire soon removed the obstacle and in ten minutes the pump was working all right.

One day a yacht owner came to me and said his injector would not work. It would not draw water and a hand-pump had to be used. Looking at the injector, I found the injector was all right and knew the trouble must be in the piping. Uncoupling, I found a piece of wood lodged in the pipe, though how it got there no one was able to explain.

Some time ago the manager of a plant ten miles away telegraphed to our works to send a man to examine an engine which had refused to work. I hired a horse and went out. The engine would turn about twice and stop. Then the following conversation took place : "Going to fix it ?" "Yes, if I can. What have you been doing to it." "Fixed the rod and put in packing." I looked the engine over and apparently there was nothing wrong. I suggested, however, that he had forgotten to cut the packing and had made a blind joint. He was greatly worked up at this suggestion, but after some persuasion he took a wrench and examined the packing. He hadn't cut out the centre and it was so thick the steam could not break it. Of course, the engine wouldn't work. I didn't touch the engine, but the experience cost him $15, and next time the packing for the steam-box will be cut properly.

## LOCATION OF CONDENSER.

Many engineers are of the impression that placing a jet condenser and air pump above the floor of an engine room will cause trouble. Nevertheless, there are many plants in operation where the condenser is placed above the engine-room floor. The main reason for putting the condenser below the engine-room floor is doubtless to utilize the waste space in the basement, if it can be called such. In one instance two engines exhausted into the same jet condenser, the piping under the floor extending up vertically from the horizontal pipe and entering the condenser at the top, this being necessary because the condenser and air pump were on the floor above. The condenser would operate most satisfactorily for several hours and then suddenly lose its vacuum, and as the condenser was not equipped with an automatic atmospheric valve, one can imagine that there was some tall hustling done to get the atmospheric valve open in time to prevent the engine from slowing down, due to excessive back pressure.

After getting the condenser cooled off, it would be started up, the exhaust steam valve to the condenser opened, and the atmospheric valve on the exhaust pipe closed. If the thing was managed rightly, a vacuum was maintained ; but this was not always the case, and the performance had to be repeated, when the engine would operate for several hours before a repetition occurred. This did not happen for very many days, but it did until the trouble was located and remedied.

The trouble was eventually found to be due to an accumulation of water of condensation in the exhaust pipe until it reached a sufficient volume to retard the exhaust steam, when it was carried into the condenser in a body, flooding it and breaking the vacuum. As the firm was not flush with money, I devised a scheme, says a writer in the "Engineers' Review," for getting over this trouble, as follows ;

A receiver was made by using a piece of 14-in. flanged pipe, both ends having heads made of blank flanges, a glass water gauge being placed at the upper end of this receiver. A 2-in. hole was drilled in the tap at the bottom of the exhaust pipe where it turned vertically, and a pipe extended from this hole to the receiver, which was placed next to the floor under the exhaust pipe. A drain-pipe with a valve and an air valve was also placed on the receiver, the air valve being at the top. By closing the drain and air valve, and leaving the valve between the receiver and the exhaust valve open, the water of condensation dropped by gravity into the receiver. Of course, the glass in the head of the receiver indicated when the receiver was full of water.

In order to empty it, it was necessary to close the valve in the connecting pipe between the exhaust pipe and the receiver, and the drain and air valves opened. The drain and air valves were then closed and the connecting valve opened slowly, so that the vacuum might not be weakened in the exhaust pipe by the sudden rush of a large volume of air from the condensation receiver.

There are cases where engines have been wrecked due to the backing up of water from a jet condenser. It will usually be found, however, that this is done where the engine has been slowed down and the regular amount of injection water permitted to flow, and if the pump were direct-connected to the engine, it would, of course, slow down also, with the consequence that it would not take care of the water, so that the condenser and exhaust pipes would soon be flooded.

With the engine running slowly at practically no load, the steam would expand below atmospheric pressure ; therefore there was nothing to prevent the entrance of water from the exhaust pipe when the exhaust valve opened. If water did enter the cylinder, the liability would be that the cylinder head would be knocked out or the piston rod bent or otherwise damaged, because the exhaust valve would close before the end of the return stroke was reached. As water is non-compressible, it is easily seen that the conditions would be good for a wreck.

## LEAKY VALVES.

By Canuck.

As chief engineer I have charge of a power plant of 1,700 h.p. There is a vertical triple expansion engine direct connected to two generators, one on each end of the shaft. Some time ago I had a little trouble with it. I could not get the h.p. out of it, so I decided to put the indicator on it and find out what was the trouble. I soon found out the l.p. valves were leaking very badly. I had them taken out and found they were worn out of shape. It was up to me to repair them. The engine being an American make, I could not get a pattern of the valve, and I had not time to get one made, so new valves were out of the question. The valves are of a piston type, with no rings in them, and I could not put any rings on them because the steam parts in the valve chamber are not bridged. I therefore decided I would turn a ¼ inch off them and shrink a machine steel casing on them.

I had eight forged steel bushings made by the blacksmith out of solid steel, so there would be no fear of the weld giving way in the shrinking on the valve. I had the bushings taken into the machine shop, bored out to shrinking fit, and rough turned on the outside to a 1-16 inch of the finished size, and then had them shrunk on the valve. Then I had four ⅜ inch tapping holes drilled through the steel casing and into the valve, tapped the holes and screwed a tight fitting screw into them. Then I turned the valves up to fit the valve chambers, put them in, started the engine, and they have given no trouble since. This was done for less expense than new valves would cost.

## HAVE YOU DIFFICULTIES?

Some times you may have difficulties in the power plant, and you are not sure of the proper method of overcoming them. If so, write us about it. State your trouble as clearly as possible and we will publish it in the next issue of Power House. Your name will not appear if you wish it withheld.

We will ask other engineers to answer the problems and discuss the questions that arise in the power plants. In this way you will be able to obtain the prac-

tise of engineers who have overcome the difficulty.

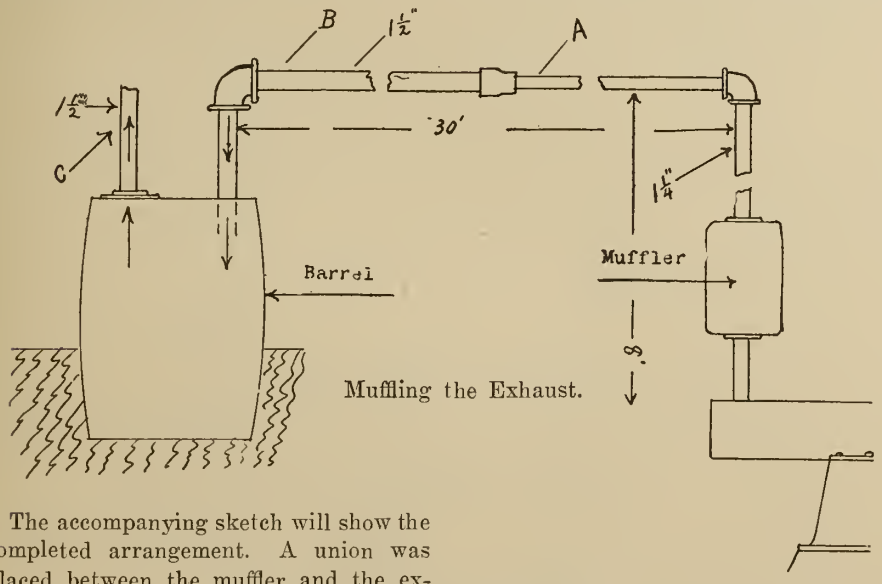
Address Power House, 10 Front St. East, Toronto, and your letter will reach the editor.

## MUFFLING THE EXHAUST.

By E. S. Cooper.

Some time ago it came our way to instal a small gas engine to furnish the power for blowing a pipe organ in a city church and it can be readily understood that the results usually obtained by the ordinary form of muffler could not be tolerated in such a situation. To meet the requirements of the contract, which called for a noiseless exhaust, may seem at first though, to call for some elaborate scheme of a special muffler that would have added to the expense. To avoid this, the job was successfully done in a very simple manner and was quite satisfactory to the purchasers of the outfit.

An ordinary coal-oil barrel was secured and set into the ground about 15 inches and close to the wall of the building. As the engine sat about 30 feet from the position of the barrel it was thought best to enlarge the size of the exhaust pipe at the outer end and also to use the ordinary cucumber muffler, that was part of the regular engine equipment, as close to the engine as possible.




Muffling the Exhaust.

The accompanying sketch will show the completed arrangement. A union was placed between the muffler and the exhaust box of the engine, but is not shown in the sketch. Into the barrel head was cut a hole about one-half in. larger than the outside diameter of the exhaust pipe and the piping was allowed to extend into the barrel some 5 or 6 inches. At A a hanger fastened to a joist supported the pipe and at B it passed through the brick wall which was afterwards closely filled with cement. C is the outlet pipe from the barrel and this had a plain flange at the lower end which covered a 3-inch hole in the barrel head and was fastened with wood screws. Before placing the pipe C in position over the opening, sufficient stones and broken brick were passed through the hole to cover the bottom of the barrel to a depth of about 6 inches. These were as large as would conveniently pass through the hole and their purpose was to break up the stream of the exhaust before it turned upward to pass out of the pipe C.

This pipe was given a long double bend to bring it against the wall and then led up to beneath the overhanging roof and fastened in place there. Wedges were then driven around the pipe entering the barrel, the barrel packed around with the earth taken out of the excavation made to set it into, and the job was completed and ready for trial. On starting the engine it was found the result was all that could be desired, for when standing inside the church, and close the window nearest the exhaust, a very slight puff was all that could be heard and the job was accepted as satisfactory.

For our own information as to whether any back pressure was made by this instalation, the union near the engine was uncoupled and the exhaust allowed to escape into the basement for a few minutes. With the engine running free we found absolutely no increase in the number of exhausts taken place in a given time. When tried under load there was found to be a difference of about 3 per cent. between when exhausting into the whole pipe line and when it was uncoupled near the engine. This was such good results that it was thought useless and unnecessary, to attempt to improve it. The comparative cubical contents of the engine cylinder and the barrel allowed such a complete expansion that the absence of any noise is readily understood.

Some time after this when calling on the owner of a 6 h.p. engine which I had installed, it was found that the only objection to it was that the householders in the neighborhood found the noise of the exhaust objectionable. This was remedied by the use of a barrel with the exhaust pipe run into the side of it and allowed to escape through twenty ⅜-inch holes bored around the top of the barrel just below the head. The situation did not call for any outlet pipe and the small holes cured the objection to the noise completely and this has now been in use for about six years very satisfactorily.

The small engine is usually equipped with an exhaust pipe of sufficient size to answer alright for instalations where only a few feet of pipe are required to carry the exhaust outside, but when it comes to a situation when it is necessary to use from 40 to 60 feet of piping for that purpose there is generally trouble. This is especially so if a few elbows are used in the line, as every elbow obstructs the free flow of the exhaust and tends to make back pressure. It is an easy matter to test this part of the instalation and if there is any idea that back pressure exists it is well to do so. Start the engine running, put on the load and note how many charges are taken into the cylinder in one minute. Now disconnect the exhaust as close to the engine as possible and note the number of charges taken in the same space of time and with the same load on. The difference between the number of charges taken just represents the loss caused by the long line of pipe and it will be necessary to use a larger size that will eliminate the greater part of the difference.

On going to investigate a complaint that an engine was not doing near the amount of work expected of it, we found on arrival at the plant that there was 62 feet of piping used on the exhaust and in that line there were four elbows. By disconnecting a union a few feet from the engine it was found that it could easily handle the load and saved one-third of the charges taken into the cylinder, but when the pipe was coupled up and the exhaust had to be forced out through the long length of pipe. A larger pipe and the removal of two of the elbows remedied the matter satisfactorily.

## A HANDY TUBE CUTTER.

By G. Campbell.

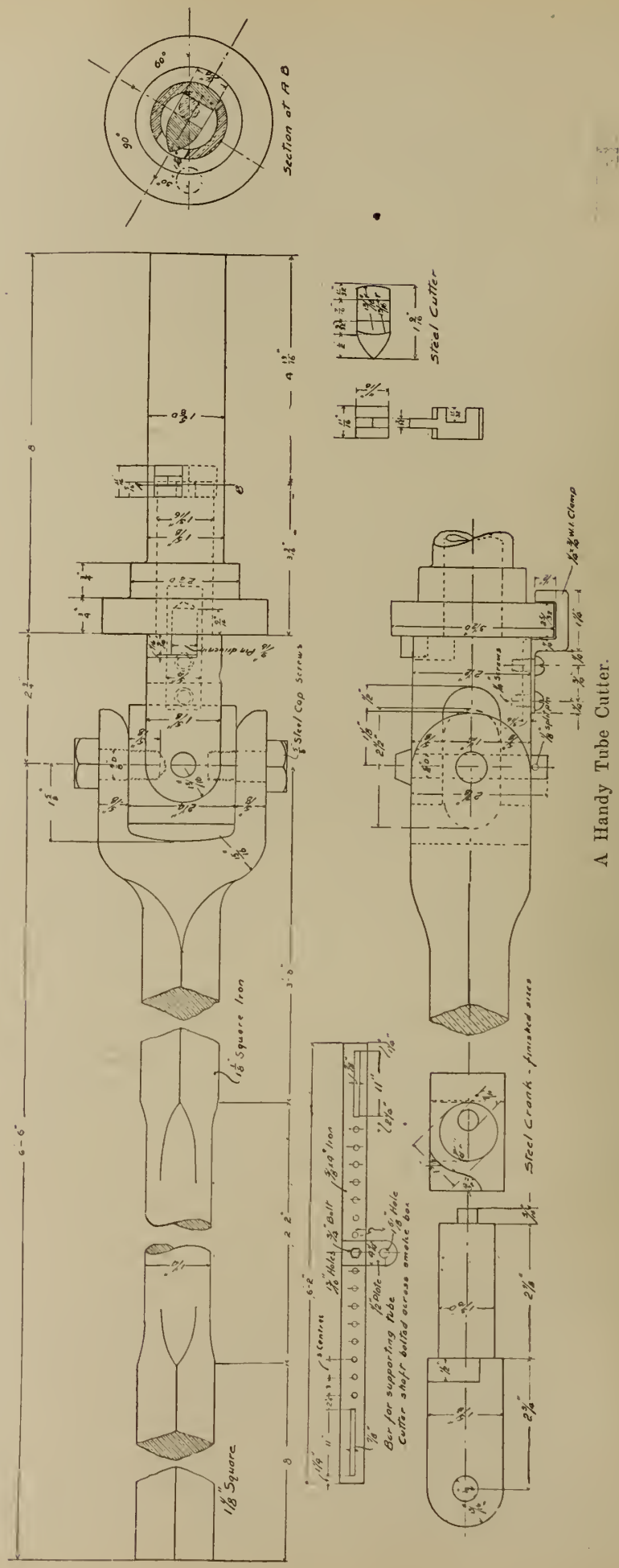
The tubes of a locomotive boiler become covered with scale, overheated and then they finally blister. These blistered tubes must be replaced at once if the locomotive is to be retained in service. In the G.T.R. at Stratford, Montreal and Toronto, a handy device is used for cutting out the tubes.

The accompanying sketch illustrates this tool, giving dimensions of the various parts. The steel cutter is seven-sixteenths inches from the shoulder, and the cutting point is one-eighth inch back from the centre. The cutting edge is 7-32 inch face and 1/8 inch at back, thus giving a clearance. The slot is 11-32 inch deep, and in this the small eccentric crank pin works. Reversing the tool draws the cutter into the crank or mandrel and the tool may then be removed from the flue. The travel of the eccentric is 1/2 inch, the crank pin being 1/4 inch from the centre. The pin is slightly longer than the depth of the slot in the cutter, so that the pin reaches to the back of the slot.

The steel crank is 2 7/8 inches long, and is 1 3-16 inches in diameter. The tube rests against the smaller collar. The centre of the blade is 1 11-16 inches from the collar cutting off 1 5/8 inches of the tube. The corner on the shoulder of the mandril is cut out as shown in the sketch, and a pin working on this curve throws the cutter into working position or the reverse. This pin on the large collar stands best when made of wrought iron and case-hardened.

A small clamp made of machinery steel and case-hardened holds these two parts together. The handle is connected to the tool by means of a toggle joint. At the G.T.R. in Toronto the handle is arranged for extension. In place of the square iron handle running all the way, a 1 3/4 tube has been forged on at the toggle joint. This tube is 2 feet 2 inches long and is squared at the outer end to receive a 1 inch square iron. The awkwardness of a long handle is thus removed as the iron rod can be run in or out of the tube to the required length. A collar is welded over the outer square end of the tube to insure strength.

The bar for supporting the tube cutter is bolted across the smoke box. The holes are drilled with 3 inch centres, but usually the rest plate is only shifted three or four times, cutting the tubes from a boiler as the toggle joint allows the tool to be used in any position. Adjustments on this bar allow it to be fitted to a large or small smoke box. The tool is worked by a ratchet wrench, and a few turns cut the tube from the boiler.


Section at A B
Steel Cutter
Steel Cap Screws
1 1/8" Square Iron
1 1/8" Square
Steel Crank - finished size
Bar for supporting Tube Cutter shaft bolted across smoke box.

A Handy Tube Cutter.

## CHANGES FOR A BETTER SERVICE.

By J. A. C.

Sometime ago the firm by whom I am employed engaged a new master mechanic for their 1,500 h.p. mining plant, and as it was in bad condition at the time, some of the changes made by him are of interest to power-plant men. The plant consists of a 1,000 h.p. boiler house, power house containing air, electric and pumping engines, machine shop, etc., and

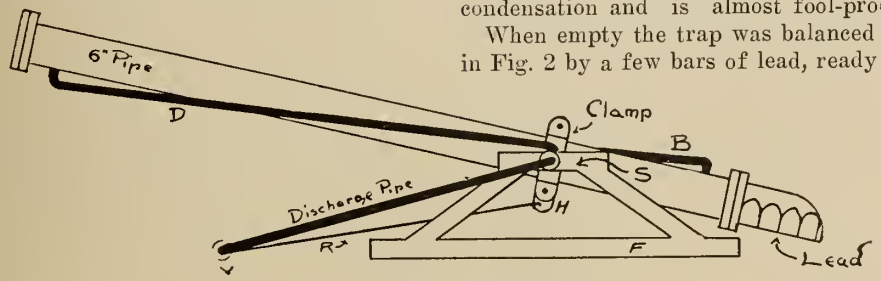



Fig. 1—The Trap—Side View.

another boiler plant with several engines scattered around within a radius of half a mile.

As the boilers were badly scaled up he made them his first work, had the tubes taken out of one boiler at a time (return tubulars) and cleaned them thoroughly in a "rumbler" made for the purpose. This he constructed in the form of a cylinder out of No. 10 sheet iron, a little longer than the 18 ft. tubes, lagged the outside with 2x4 scantling and used a piece of 6-in. pipe for the supporting shaft. This in turn was supported at each end by wooden trusses for bearings. A section of the cylinder end was left open to insert the tubes and some coarse gravel; the cylinder diameter would be about 4½ ft. and would take 40 to 50 tubes at a time. After placing the tubes inside, the rumbler was revolved about 20 or 25 r.p.m. by a small vertical engine whose belt passed around the outside of the lagging, thus getting the speed down low enough. A few hours in this machine would effectually take the scale off, leaving the tubes ready for cutting and welding.

While the boiler repairs were going on he had all the old heating system in the largest buildings torn out and reconstructed with a view to piping the radiator returns to a central return header which he drained with a home-made trap, of which the following is a brief description: a piece of 6-in. pipe with a blanked flange on each end was supported on a frame by a clamp with hollow trunnions at about ¼ of the distance from the end, as shown in the plan view, Fig. 1. The beauty of this trap is that it is simple, will handle large quantities of condensation and is almost fool-proof.

When empty the trap was balanced as in Fig. 2 by a few bars of lead, ready to receive the water which would accumulate until the long end of the 6-in. pipe tipped down and allowed discharge to take place. The action is as follows: Condensation enters through pipe A, which is connected to trunnion by stuffing box S, and through trunnion and pipe B to short end of pipe body. After sufficient water has collected to dip the long end and over-balance the lead counterweight, the trap is discharged by a rod R, opening valve V by being connected to lower end of the clamp at H. When the trap has discharged, the counterweight tips the long end up again, and this movement closes the discharge valve ready to hold the condensation till the next dump.

Having secured a large quantity of the best of feed-water by piping these traps to the hot-well, the master mechanic next turned his attention to the jet-condenser in the power house. It was discharging into the sewer at about 80 to 90 degrees. He had the piping re-arranged so that by adding about 3 feet onto the discharge head, the discharge would go to the hot-well in the boiler house about 100 feet distant. An overflow flume was taken from the hot-well and emptied into another flume in front of the boilers, under the floor, into which the ashes were dumped and carried away. The water required for this flume before had always caused the main pumps to be run 50 per cent. faster than normal, so that there was thus a big saving even without counting the hot feed-water saved. Needless to say, the boilers were much easier kept clean after getting better feed water.

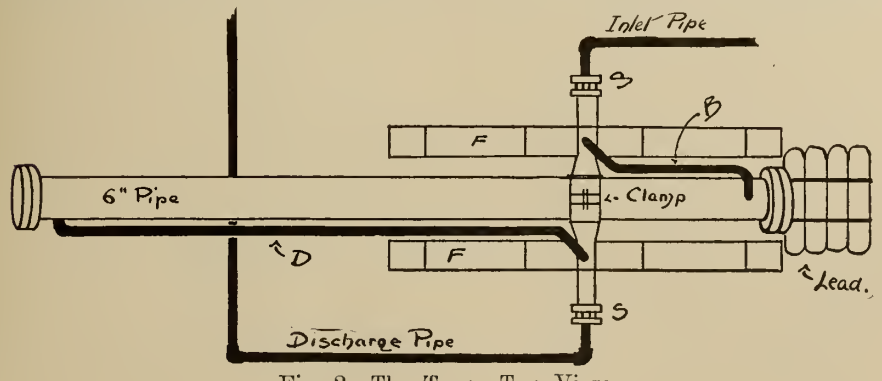



Fig. 2—The Trap—Top View.

---

## BELT TRANSMISSION.

By J. H. R., Hamilton.

The simplest and most usual arrangements of belting is by the use of open and crossed belts. The velocity ratio of all belt transmissions is inversely as the diameter of the pulleys.

For parallel shafting the only requirements necessary are that the pulleys should be slightly crowned and in line with each other, and the shafts lined up parallel. If guiding flanges must be used they should be recessed out at a, a, Fig. 1, as the belt will be guided on the pulley at point b, and being free from the flange until it leaves the pulley on the other side.

If flanges are left straight as in Fig. 2, the belt will be inclined to ride up on the flange as at d, causing undue friction and loss of power. When shafts are to be connected at right angles, but not intersecting, the common method is by a quarter turn belt, shown in Fig. 3. D is the driver and F the driven pulleys. The point of delivery from pulley D must lie in the middle plane of pulley F, and vice versa. Thus arranged the pulleys cannot run backward without dislodging the belt, because d, the point of delivery of F, is not in the middle plane a, a, and e is not in the middle plane b, b.

The objection to the quarter turn belt is that the belt is strained, especially at the edges, when the angle at which the belt leaves the pulley is large. Using small pulleys and narrow belting with shafts quite a distance apart, will overcome this to some extent, but, in any case, much power is lost by the use of quarter turn belts. In Fig. 4, the arrangement is somewhat improved by the use of a guide pulley on the slack side of the belt as shown at d. The working face of pulley d must be at the intersection of the planes a, b and c, d.

When two shafts are to be connected which are in a horizontal plane and would intersect if prolonged an arrangement like Fig. 5 is usually used. Guide pulleys like those shown at G and $G_1$, called mule pulleys, are used with flanges on the lower side to keep the belt from falling off.

Guide pulleys are sometimes used to lengthen the belt between two shafts which are too close together to be directly connected or where two pulleys

cannot be placed in the same plane. If the shafts are to run in either direction they should be arranged as in Fig. 6, the diameters of the guide pulleys being the distance between the planes of the two pulleys. But if the shafts are to run only in one direction it is more easy to place the guides on one shaft, as in Fig. 7, the belt being delivered from D to G to $F_1$ to $G_1$ and back to D, care being taken to have the belt delivered so as to strike the middle plane of the next pulley.

Fig. 8 shows two shafts connected which are not at right angles with each other. As the guide pulleys are running in the same direction they can be fastened on one shaft and the belt run in either direction.

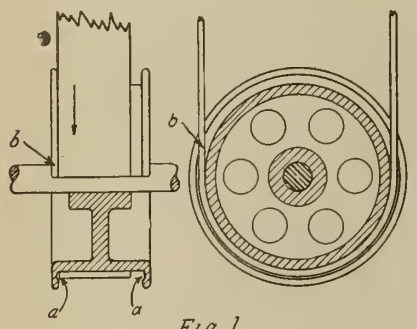


Fig. 1.

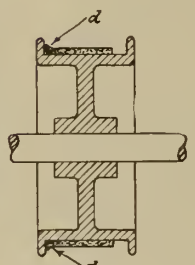


Fig. 2.

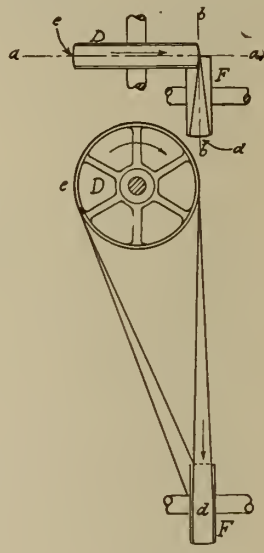


Fig. 3.

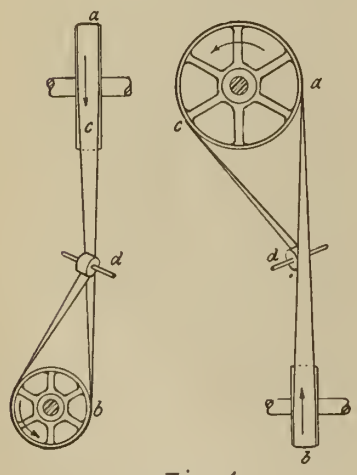


Fig. 4.

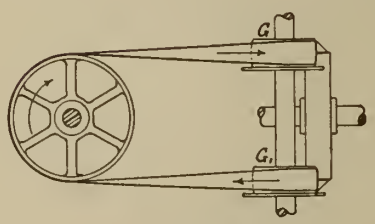


Fig. 5.

Belt Transmission.

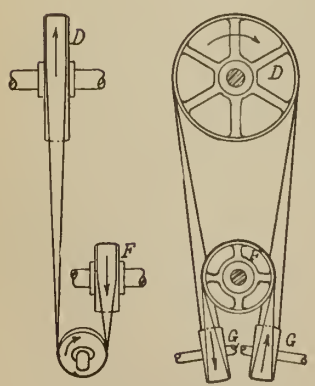


Fig. 6.

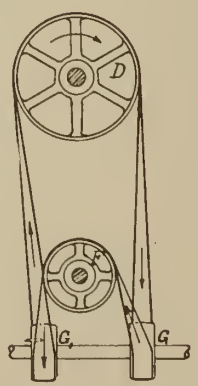


Fig. 7.

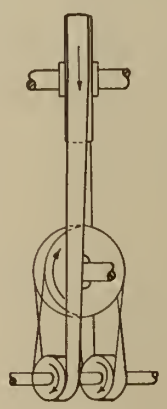


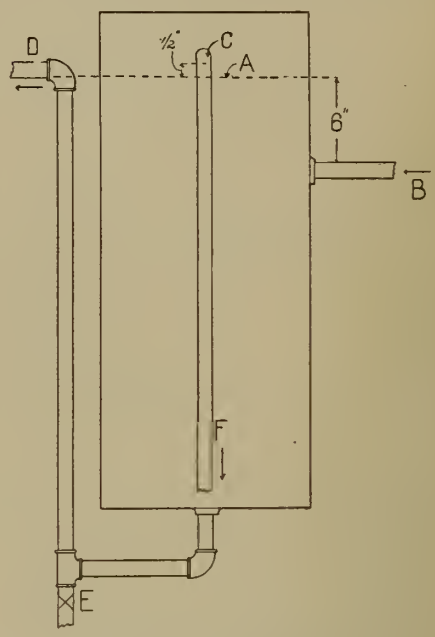
Fig. 8.

## A SERVICEABLE OIL SEPARATOR.

By George A. Wilkie.

Oil in still water rises to the top due to the differences of specific gravity, that of oil being less than water. In the illustration the tank is made of convenient height in which A is the level of the water in the tank. The water enters from the exhaust head through the pipe B, entering six inches below the level of the water. The water, in which are oil particles in suspension, enters through B into still water, and the oil accumulates at the top at A. The overflow C is half an inch bove the level A, and when the oil rises to level C, the oil flows through the waste pipe F.

The water pipe is fixed to the bottom of the tank and the water flows through D to the hot well, ready for use in the boiler again. Repeated tests shows practically no oil in the water. A clean pail of this water after standing two



Serviceable Oil Separator.

days showed only a slight trace of oil. The valve E is to clean the pipe out occasionally as sediments collect in the pipe and must be removed from time to time.

---

## ROPE DRIVING.

By R. Stroud.

Cotton and manilla rope drives are often used instead of leather belting and gearing, where the power transmitted is large or where it has to be transmitted a great distance.

There are two systems of rope driving, the American system and English or multiple system. A feature of the American system is that a single continuous rope is used, or, in other words, it is wound on the sheaves spirally. The English system is to use a different rope for each groove.

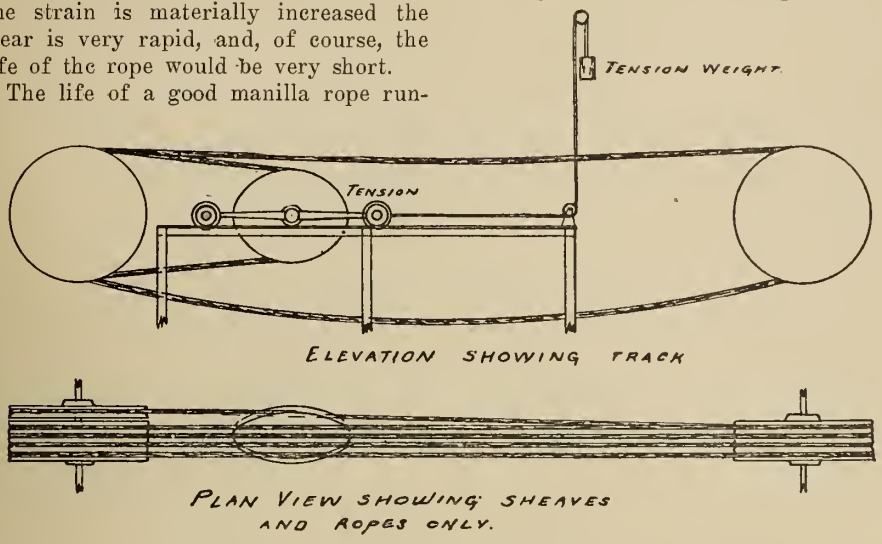
To take up the slack on the American plan of rope drives, a tension carriage with an Idler sheave, is used, as shown in the line cut. This tension carriage runs on a track either in a vertical or a horizontal position, and usually has a rope fastened to the end of it. The other end of this rope is carried over small sheaves at the other end of the track where weights are put on to it till the required amount of tension on the drive is attained. This saves unsplicing and taking out a piece of rope when the rope stretches with wear.

Transmission ropes are usually used from ¾ inch to 2 inches in diameter, and

the economical working strain should be about 225 pounds per square inch. If the strain is materially increased the wear is very rapid, and, of course, the life of the rope would be very short.

The life of a good manilla rope running on large rope sheaves with about 225 pounds per square inch strain should be 6 years approximately. The size of rope sheaves have an important effect on the wear and length of life of the rope; the larger the sheaves the less the fibres of the rope slide on each other and the less internal wear on the rope.

The usual practice is to have the diameter of the rope sheave not less than 35 times the diameter of the rope. This will apply to the idler and tension sheaves, as well as the driving rope sheaves.




### Power Transmitted.

In the table of horse powers it is seen that the h.p. increases with the speed until it reaches 4,500 feet per minute. At 6,000 feet the h.p. is less, and at 8,000 feet per minute there is practically no effective h.p.

| Dia of Ropes | Horse Power of Transmission Rope at Different Speeds. Speed of Rope in Feet Per Minute. | | | | | | | | | | Smaller Diam. of sheave in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,500 | 2,000 | 3,000 | 3,500 | 4,000 | 4,500 | 5,000 | 6,000 | 7,000 | 8,000 | |
| ¾'' | 3.3 | 4.3 | 5.8 | 6.5 | 7.3 | 7.8 | 7.8 | 7.3 | 4.6 | 0 | 32'' |
| ⅞'' | 4.5 | 5.9 | 8.2 | 9.1 | 9.6 | 10.6 | 10.6 | 9.5 | 6.8 | 0 | 36'' |
| 1 '' | 5.8 | 7.7 | 10.7 | 11.7 | 12.6 | 13.4 | 13.4 | 12.2 | 8.10 | 0 | 44'' |
| 1¼'' | 9.2 | 12.1 | 16.8 | 18.4 | 20.0 | 21.2 | 21.2 | 19.5 | 13.9 | 0 | 56'' |
| 1½'' | 13.1 | 17.4 | 23.1 | 26.7 | 28.6 | 30.4 | 30.4 | 28.4 | 20.0 | 0 | 60'' |
| 1¾'' | 18 | 23.7 | 32.8 | 36.5 | 39.0 | 41.3 | 41.3 | 37.6 | 27.4 | 0 | 72'' |
| 2 '' | 23.2 | 30.8 | 42.8 | 47.3 | 50.9 | 54.2 | 54.2 | 51.4 | 34.10 | 0 | 82'' |

The reason of this is the centrifugal force of the rope, running over the pulley, will reduce the amount of force available for the transmission of power, and at 8,000 feet per minute the centrifugal force equals the assumed allowable tension of the rope.

Rope drives to be run economically should not be driven any faster than 3,500 feet per minute; this is about the usual practice.

The second table shows the approximate sag of the driving side and of the slack side, that the rope should have. The sag varies from these figures under certain conditions and the table does not consider special cases:

| Distance between pulleys in feet. | Sag of Rope Between Pulleys. Driving side all speeds. | Slack side of rope. 80 ft. per sec. | 60 ft. per sec. | 40 ft. per second. |
|---|---|---|---|---|
| 50 | 6'' | 11'' | 13'' | 15'' |
| 70 | 1'— 2'' | 1'—10'' | 2'— 1'' | 2'— 4'' |
| 90 | 1'—10'' | 2'—10'' | 3'— 4'' | 3'— 9'' |
| 110 | 2'— 5'' | 4'— 8'' | 5'— 8'' | 6'— 9'' |
| 140 | 3'— 8'' | 7'— 4'' | 8'—11'' | 9'— 8'' |
| 170 | 5'— 6'' | 9'—10'' | 11'— 7'' | 14'— 4'' |

The grooves on rope sheaves are usually turned out at 45 degrees to 60 degrees, varying with the different ideas of engineers. They should be turned out fairly smooth, as any roughness from tool marks will cut the fibres one by one, thereby giving the rope a short life. All sand or blow holes must be filled up as they will quickly cut the rope.

Spencer Miller, in a paper entitled "A Problem in Continuous Rope Driving," says that an angle of 45 degrees should be adopted, as the minimum angle in the smaller sheave; and recommends that the larger pulley be grooved out at a wider angle so that the resistance to slipping will be the same. In a drive such as he recommends, the wider angle in the larger sheave there is no power lost, but in reality a great amount of power gained.

## PISTON SPEED AND STEAM ENGINE ECONOMY.*

By Professor R. L. Weighton.

Some time ago a series of revolution trials were carried out on the experimental engines in the Engineering Laboratory at Armstrong College, Newcastle-upon-Tyne. The primary object of the trials was to ascertain by careful experiment the exact effect upon the steam consumption per brake horsepower of running engines of ordinary design and proportions, at various speeds of revolution, ranging from the lowest up to the highest practicable, nothing being altered throughout the series except the resistance against which the engines were working. A second object was to discover, if possible, the maximum permissible speeds of steam and exhaust in such engines, with due regard to economy—this last with a view to the determination of the minimum sectional dimensions of the steam and exhaust ports, openings and passages, for adoption in proposed engines of this type, without entailing sacrifice of economy in working. Other objects might be mentioned—e.g., the determination of the effect of speed of revolution upon mechanical efficiency, and upon total power developed; but all such may be regarded as subsidiary to the two objects just stated, these latter being of a character calculated to have a direct and important bearing upon practice. Obviously the only true power of an engine is the brake power, this representing the power available for the performance of the useful work, to do which the engine was built.

Two separate sets of trials were carried out, one with the engines arranged as quadruple, and the other as triple expansion, otherwise the conditions were as nearly as practicable identical for both sets, as follows:—Quadruples: Cylinders, 7, 10½, 15½, and 23 in. diameter; 18-in. stroke. Triples: Cylinders, 10½, 15½ and 23 in. diameter; 18-in. stroke. Steam pressure in high-pressure chest, 138 lbs. per square inch,

*From a paper read before the North cast Coast Institution of Engineers and Shipbuilders.

absolute; vacuum in condenser (barometer 30 in.), 24½ in. of mercury. Jacket steam shut off and jacket drains open. Receivers continuously drained by hand into hot-well. Amount of lubrication of steam and of bearings the same on both trials. Steam cut off in quadruples at 12½, 10½, 10½ and 10½ in. respectively; steam cut off in triples at 6, 10½ and 10½ in. respectively. Engines in both cases linked up very slightly and to exactly the same amount in every trial.

In all the trials great care was taken to secure uniformity in the quality of the steam entering the first cylinder, by resorting to hand drainage of the high-pressure steam chest, the water from which was, of course, not included in that debited against the engines. The steam pressure is low for use in quadruples, but it was purposely chosen so in order that there might be no doubt about the ability of the boiler to maintain the pressure constant at the higher piston speeds. The vacuum also was kept low in the interests of economy of condensing water. So far as the writer can see, neither the degree of steam pressure nor the vacuum can, within limits, materially influence the comparative or qualitative nature of the results. Quantitatively both of these factors would, of course, have an important influence.

The variation in speed of revolution was brought about by adjustment of the dynamometer, the lowest speed in each case being that which resulted when the dynamometer was adjusted for maximum resistance.

The economic effect of working at various steam pressures or at various expansions, and at constant revolutions, is, of course, well known. The trials here dealt with showed the effects of working given engines at various revolutions and at constant steam pressures and expansions.

The outstanding results of the trials here recorded may be summarised as follows:

1. For every reciprocating steam engine, when change in power is brought about by change in piston speed, there is a certain limit of piston speed at which maximum power is attained, and beyond which the power will fall as the speed is increased.

2. For every reciprocating engine, when change in power is brought about by change in piston speed, there is a certain limit of piston speed with which is associated maximum economy of steam used per horse-power developed.

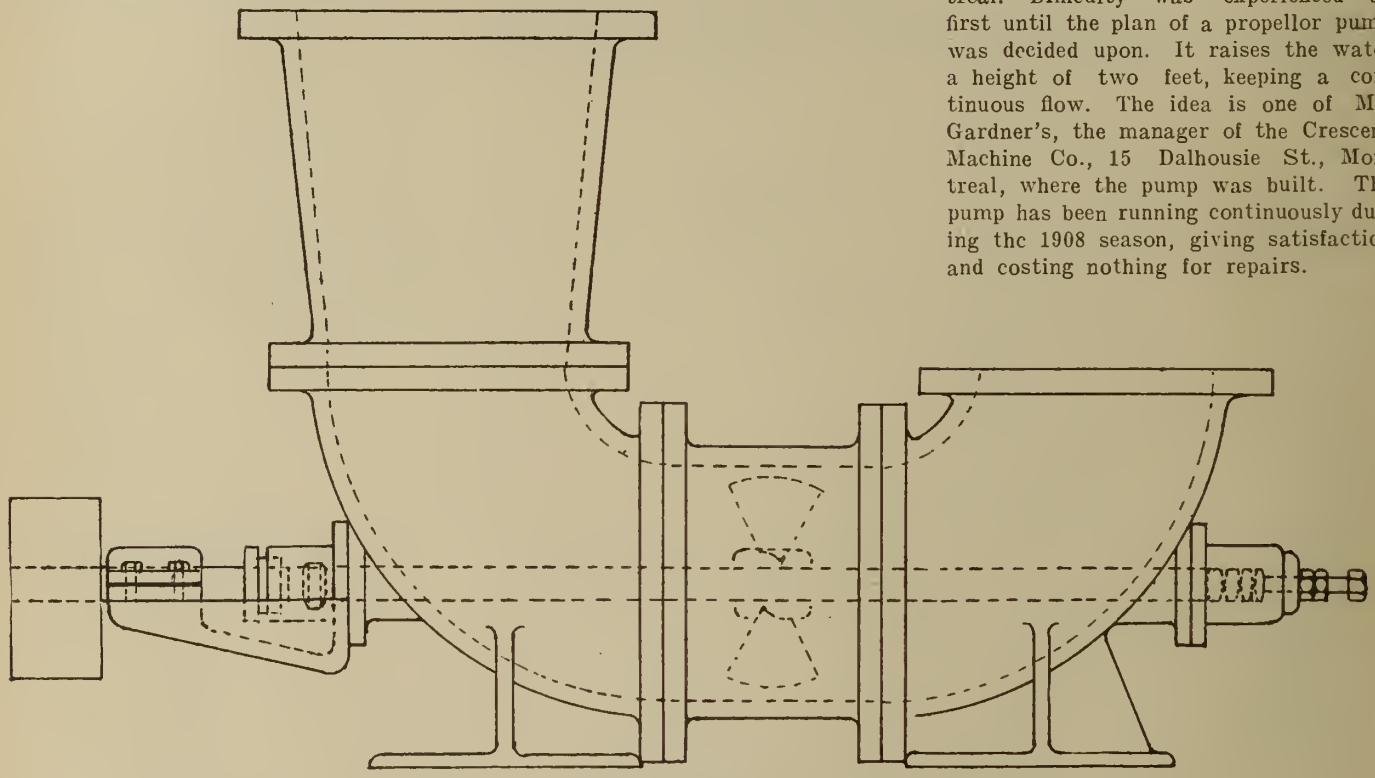
3. For the engines and conditions of the trials, maximum economy in steam used per brake horsepower occurred for quadruples at a piston speed of 411 ft. per minute, and for triples at a piston speed of 474 ft. per minute, the corresponding mechanical efficiencies being for quadruples 0.856, and for triples 0.87.

4. The maximum-economy piston speed depends on several factors, the exact influence of each of which remains to be ascertained, but to a very large extent it is determined by the mechanical efficiency of the engines. An increase in the value of mechanical efficiency will, other things being unaltered, not only raise the economy absolutely, but will advance the maximum-economy point on the scale of piston speed.

5. Both maximum-power and maximum-economy piston speeds are for the brake-power considerably lower than for the indicated power, and therefore if the indicated horse-power were alone considered, the piston speed of maximum economy would appear to be considerably higher than it is in reality.

## UNIQUE PUMP INSTALATION.

A unique propellor pump used in the Mystic Rill at Dominion Park, Montreal. Difficulty was experienced at first until the plan of a propellor pump was decided upon. It raises the water a height of two feet, keeping a continuous flow. The idea is one of Mr. Gardner's, the manager of the Crescent Machine Co., 15 Dalhousie St., Montreal, where the pump was built. The pump has been running continuously during the 1908 season, giving satisfaction and costing nothing for repairs.



Unique Pump Instalation.

## ENGINEERING AT Y.M.C.A.

Classes have re-opened at the Montreal Y.M.C.A. and class instruction, lecture and demonstration will be given in boiler firing; boiler, engine and machine design; mechanical drawing and mechanical engineering. Some new features which will be considered in detail are estimates, operating and construction costs, fuel savings, smoke prevention and kindred appliances for increasing efficiency and economy. The classes are held for firemen, engineers, mechanics, draftsmen etc., and Peter Bain, consulting mechanical engineer, has charge of this department of the association's work.

The central branch of the Toronto Y.M.C.A. have opened two new departments to their evening classes, electricity and mechanical drawing, for young men who wish to qualify as master mechanics, foremen and draftsmen.

## SOCIETY OFFICERS.

**Canadian Railway Club, Montreal.**

President, L. R. Johnson; treasurer, S. S. Underwood; secretary, James Powell, Box 7, St. Lambert, near Montreal. Meetings at Windsor Hotel, 1st Tuesday of each month, except June, July and August.

**Central Railway and Engineering Club, Toronto**

President, W. R. McRae; secretary-treasurer, Room 409, Union Station. Meetings at Rossin House, 3rd Tuesday of each month, except June, July and August.

**Canadian Society of Civil Engineers.**

Rooms at 413 Dorchester Street West, Montreal. President, J. Galbraith; secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1909.

**Nova Scotia Society of Engineers, Halifax.**

President, J. H. Winfield; secretary, S. Fenn, Bedford Row, Halifax, N.S.

**Quebec Branch of the Canadian Society of Civil Engineers.**

Chairman, E. A. Hoare; secretary, P. E. Parent, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

**Toronto Branch of the Canadian Society of Civil Engineers.**

96 King Street West, Toronto. Chairman, C. H. Mitchell; secretary, T. C. Irving, Jr., Traders Bank Building.

**Manitoba Branch of the Canadian Society of Civil Engineers.**

Chairman, H. N. Ruttan; secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

**Engineers' Club of Toronto.**

96 King Street West. President, J. G. Sing; secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

**Canadian Electrical Association.**

President, N. W. Ryerson, Niagara Falls; secretary, T. S. Young, Canadian Electrical News, Toronto.

**Canadian Society of Stationary Engineers.**

President, Charles Kelley, Chatham; secretary W. A. Crockett, Mount Hamilton.

**Toronto Branch A.I.E.E.**

Secretary, W. G. Chace, Confederation Life Building.

## C. A. S. E.

The address of the secretary is W. A. Crockett, Mount Hamilton.

A scheme is now being developed to give the engineer greater opportunities to increase his knowledge and make him a very important factor in a manufacturing plant. The secretary of the C. M.A. is being approached in regard to technical education and it is hoped that a satisfactory scheme will be formulated to make a fireman more than a shoveller of coal, to raise the status of the oiler, and make the engineer a man who will be appreciated by the manufacturer.

## ENGINEERS' CLUB, TORONTO.

The opening meeting of the Engineers' Club was held on October 1, at which W. G. Bligh, M. Inst. C.E., read a paper on the "Design of Irrigation Headworks Founded on Sand."

On October 8 there was a demonstration of Price's Automatic Railway Signal. The Price system of automatic signaling and train controlling is a system using electrical circuits. An electrical current similar in volume to that of an ordinary house bell passes continuously along the rails of each block to a coil. This magnetizes the coil and causes it to hold up a small armature. The presence of another train or obstruction on the line short circuits this current, and it ceases to pass through the coil. When this happens, the coil being no longer magnetized, allows the armature instantly to drop, and as a result, a small port located in the cab of the engine is opened, through which compressed air rushes into a chamber, gradually applying the brakes and automatically holding them set as long as may be necessary.

The following is the programme for October, 1908. On Oct. 15 is a club smoker at their rooms, 96 King Street West; Oct. 22, a paper, Toronto Harbor, by W. J. Fuller, and Oct. 29, a discussion, Viaduct vs. Bridges, introduced by F. L. Somerville.

## PERSONAL.

K. L. Aitken, who has been appointed to the position of electrical engineer at Toronto, in connection with the municipal power scheme, is a Toronto man. He obtained his Public and High School education in Canada and the United States. From 1897 to 1899 he held a clerical position with Westinghouse, Church, Kerr & Co., New York City. For the two years following he was in the shops of the Sprague Electric Company, Bloomfield, N.J., after which he spent one year with the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. From 1902 to 1904 he was selling engineer with the Canadian General Electric Co., Toronto, and for the past four years has been occupied as a consulting engineer. Some of the plants he has constructed are: A complete steam and electrical equipment for the Town of Milton, covering incandescent and street lighting, 100 horse power; a complete electrical equipment for the Town of St. Mary's, 250 horse power, and also for the Town of Barrie, 500 horse power.

F. H. McGuigan, who obtained the contract for the building of the Ontario Government's transmission line (the largest in the world) was forty-five years ago a water carrier for a construction gang on the Erie & Pennsylvania road. In 1880 he became foreman of construction and divisional roadmaster on the Wabash. Promotion quickly followed to superintendent of the Grand Trunk. After he had demonstrated his ability in several positions, including the office of fourth vice-president, on the Grand Trunk, the keen eyes of James J. Hill spotted him as a man for the Great Northern. He became vice-president of that road in April of last year. He remained in the position only a few months. He resigned of his own volition, but the story is a railway secret. Mr. McGuigan's forte has always been construction. Perhaps it was ingrained in his blood when he carried water pails in Pennsylvania.

## GAS PRODUCTION FROM WASTE.

Walter Thomas, manager of the Vancouver Gas Works, has invented an improved gas producer, particularly designed for the generation of gas for power or illuminating purposes from waste products such as low grade coal refuse, mill waste, etc. It is claimed that this can be used with economy even on launches, and that it can be applied in almost every instance where power is used. The producer comprises an enclosed chamber lined with refractory material and having a feed hopper through which the fuel or refuse is delivered. This chamber is sub-divided, preferably into three relatively deep furnace chambers each of which is provided with an independent grate, beneath which air under pressure or of steam may be delivered at will. Each is also provided adjacent to the furnace grate with a gas delivery passage, which passages are connected through the necessary scrubbers and cleaners to the gasometers or to a gas engine if direct suction is used. In use, only one of these gas delivery passages is open at one time, and the furnaces being charged with fuel it is blown into incandescence by an air blast admitted beneath the grate. When this condition is attained the air blast is cut off and steam is delivered instead through two of them. This steam passing through the incandescent fuel is dissociated and forms what is known as water gas, which passing upward through the green fuel is enriched thereby, and carries with it the vapors and volatile elements therefrom. These pass downward first through the green and finally through the incandescent fuel of the third furnace, the gas delivery outlet of which has been left open, and in this final passage through the incandescent fuel the gas is rendered permanent by the association under a high temperature with the carbon of the fuel and with the volatile tarry matters from the green fuel and is delivered to a gasometer for storage, or to a gas engine direct, in the form of a gas eminently suited for heating or power purposes. An important feature of the producer lies in the interchangeability in the direction of the flow of the gas of the three generating furnaces, which enables any one of the furnaces to be recharged without interfering with the continuity of the gas production. The producer is particularly applicable for use in coal mines or saw mills, where refuse or waste products can be economically utilized for the generation of gas and its conversion into power.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*

OFFICES:

CANADA
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg., Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

UNITED STATES
CHICAGO - J. Purkis Sharpe, 933-935 Monadnock Block
NEW YORK - 544 West 145th St., Phone Audubon 2430, R. B. Huestis

GREAT BRITAIN
LONDON - 88 Fleet Street, E.C., Phone Central 12960, J. Meredith McKim

FRANCE
PARIS - Agence Havas, 8 Place de la Bourse

SWITZERLAND
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

**Vol. 1.** **OCTOBER, 1908** **No. 2**


## POWER SCHEMES IN EASTERN CANADA.

Several years ago, Thos. A. Edison, the wizard of electricity, predicted that the ultimate solution of the cheap power question would be the utilization of the waste products of the coal mine in a central power plant situated at the mouth of the mine. Such a scheme has been adopted by the Maritime Coal & Railway Co., at Chignecto Mines, N.S., where a power unit of 250 h.p has been installed.

A quotation from the secretary's report at the recent meeting of the Maritime Board of Trade would indicate that there was the need of such a development on a very much larger scale. The secretary said :

> "Our vast deposits of coal and iron in close proximity to an abundant supply of lumber, put us in a position to become a large manufacturing centre, while the ocean at our doors forms a great highway on which we may transport our products to every part of the world. While we have an abundant supply of raw material, particularly in coal, iron and lumber, one of our great needs, if we are to successfully compete with other manufacturing centres, is cheap power."

In the power scheme of the Maritime Coal & Railway Co., power is transmitted to Amherst, a distance of six and a half miles. The scheme has proven successful, and there is no reason why it should not be carried out successfully on a larger scale. There apparently is an opportunity here for the investment of enterprise and capital in a great work.

There is also some talk in Eastern Canada of utilizing the tides in the Bay of Fundy for power purposes. That would be an undertaking indeed. In hydro-electric power development in this country great difficulties have been overcome. Why should not this be accomplished ? At the recent meeting of the Maritime Board of Trade the following resolution was passed :

> "Resolved, that the Dominion Government be requested to offer a prize or other sufficient inducement to bring out a practicable and workable scheme to use the tidal rivers of the Bay of Fundy and its branches for the development of continuous power for manufacturing and electrical purposes ; also resolved, that the Governments of Nova Scotia and New Brunswick be urged to co-operate and do all in their power to encourage the working out of this scheme."

The Government would do well to follow out the suggestion of the Maritime Board of Trade in this respect.

## C. A. S. E. AND TECHNICAL EDUCATION.

The C. A. S. E. intend approaching the C. M. A. with a technical education scheme for the benefit of the engineer, fireman and oiler. As the C. M. A. is also interested in technical education, the committee from the C. A. S. E. will no doubt be received favorably. If the scheme is carried out, and there is no reason why it should not be incorporated in that of the C. M. A., these men will be more appreciated by the manufacturer, a fireman will be more than a shoveler of coal, the position of the oiler will be raised and the engineer, being better fitted to study and deal with problems that present themselves, will be a man of great value in the factory.

At the C. A. S. E. banquet in London in February, Hon. Adam Beck, Col. Garthshore Mr. White and Mr. Crockett pointed out the value of technical education for engineers. In Windsor the theme of the addresses were technical education and it is hoped that manufacturers will take an active interest in this problem.

While on the subject of education we believe it would be an excellent idea to arrange for the presentation of papers on subjects of interest to engineers at the convention. These would add much to the educational features of the society. We hope to see this matter taken up before the next convention and arrangements with some of the members for the presentation of educational papers. The time given to the reading of these papers will be well spent.

## UNIFORM BOILER LAW.

F. E. Leonard, London, Ont., in presenting the report of the engine and boiler section to the C. M. A. in Montreal, pointed out that boiler manufacturers were handicapped by local boiler inspectors and construction acts, which were playing havoc with the trade. What boiler manufacturers want is uniformity in the inspection laws, similar to that which had been inaugurated and carried out in the steamboat act in the Dominion. D. W. Robb,

Amherst, and Mr. Waterous also spoke on the question, pointing out the necessity of a uniform law.

At the meeting of the boiler and engine section John J. Main, Polson Iron Works, Toronto; William Inglis, John Inglis Co., Toronto; and Mr. Jencks, of Jencks' Machine Co., St. Catharines, were appointed a committee to further consider the question. A set of boiler inspection regulations has been drawn up to cover land and stationary boilers and these will be carefully considered. The matter will then be referred to the parliamentary committee and plans for bringing about the much needed legislation perfected.

The need of a Dominion law is keenly felt. At present a boiler can be made in Quebec and used there that will not be accepted in Ontario and furthermore, one acceptable in Ontario might not be allowed in British Columbia and the situation certainly needs to be remedied. It is to be hoped the Government will see the necessity of immediate action on this question when it is placed before them.

## POWER DIRECT FROM COAL.

Thomas A. Edison has made another prediction worthy of notice. So many of his dreams have come true that the outcome of his present experiments are awaited with interest. Mr. Edison says about the development of power direct from coal:

"If I do not reach it myself I will live to see the day when power will be utilized from coal without the aid of steam. We are working in that direction, and some morning the world will be informed that the discovery is a fact. Electricity is many times more effectual than steam. In a few years a steam railroad will be a novelty."

In the electrification of the St. Clair Tunnel it is found that one electric locomotive can haul twice the tonnage of a steam locomotive and accomplish it in quicker time. There is, therefore, ground for Edison's assertion that electricity is more effectual than steam. Much has been heard of "the passing of the horse" and of the turbine that was to replace the reciprocating engine. We believe that the passing of the steam railroad will not be in our day, however.

## FIRE LOSSES AND THEIR LESSON.

When fire is an enemy it is a terrible one. Insurance provides compensation, but fire eats up capital as completely as if it was devoured by the ocean.

In the United States and Canada in August over $23,000,000 worth of property was destroyed by fire; and in proportion to population the Dominion was the greater sufferer of the two.

The losses in nineteen Canadian cities and towns alone contributed $5,831,000, or rather more than one-fourth of the total loss in both countries combined.

The four towns of Fernie, Sparwood, Michel and Hosmer in British Columbia that suffered from forest fires contributed $4,100,000 to the total. Other chief sufferers in August were: Port Arthur coal docks, $500,000; Montreal, $90,000; Toronto, $140,000; West Toronto, $150,000; Gore Bay, $150,000; Newcastle, N.B., $100,000; Belleville, $67,000; Havelock, $41,000; Sault Ste. Marie, $75,000; Moncton, $30,000; Sayabee, Que., $30,000; Pottersburg, Ont., $150,000; Glencoe, $16,000; London, $107,000; Stirling, $750,000.

The lose by fire in Canada and the United States from Jan. 1 to August 31 aggregates $164,603,000.

These figures are staggering and should impress upon business men particularly the importance of taking every precaution against fire.

Proper appliances, public and private, will do much in minimizing the possibility of conflagrations, but back of it all there must be carefulness on the part of those employed in factory, warehouse and store, for nearly all fires have their origin in carelessness.

A proper fire equipment is essential in the factory, sufficient hydrants with hose, nozzles, etc., a sprinkler system covering every corner of the buildings, well trained watchmen and waste tins that should be removed from the factory every night. If paid firemen cannot be supported a number of men from each department should be carefully trained. In this way fires that have burnt down whole manufacturing plants through ignorance of employers in coping with conditions, will be caught in the beginning, thus saving both life and property.

## DO NOT MISS THE OPPORTUNITY.

We would like every reader to understand the true attitude of every advertiser in The Power House. The advertiser desires to get into touch with every buyer of his lines. The reader wishes to learn as much as he can about the most up-to-date power equipment.

The most logical way for these two classes to get together is for the reader to peruse the advertisements, the catalogue reviews, the references in the editorial columns to new equipment for power plants and when anything interests him to write for it. Write for the literature referred to in The Power House. The advertiser will appreciate such inquiries and you will get information of real value to you.

## GOVERNMENT POWER LINE.

The formal contract for the construction of the Government's power transmission lines is signed. Premier Sir James P. Whitney says of the project:

"With reference to the power question, I may say that a contract has been entered into for the construction of the transmission lines, and that a contract for electrical equipment will be let forthwith. I have every reason to believe that no delay will occur to prevent the Government from carrying out the mandate they have received from the people. In order to do this we do not propose to be either discouraged or prevented by technicalities."

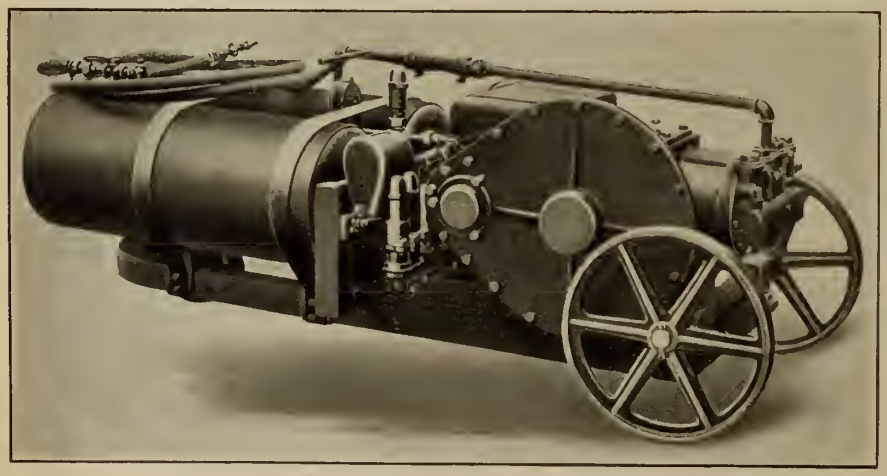
# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### A NEW HORIZONTAL BLOWING OUTFIT.

In response to the demand for a horizontal blowing outfit embracing the same general principles as the standard vertical plant, which has been in successful operation for several years, the Westinghouse Air Brake Company has designed the outfit shown in the illustration. It differs from the vertical plant chiefly in arrangement, and is intended for use where conditions do not permit convenient movement of the vertical apparatus.

Portable plants are now in wide demand for cleaning electrical and other machinery, and for many services for which compressed air is the most convenient and economical agent.



New Horizontal Blowing Outfit.

The new horizontal plant consists of a motor-driven air compressor with one or two brazed reservoirs, an electric pump governor and the usual accessories such as switch, fuse blocks, gage, safety valve, insulating hose connection, and hose with nozzle. The truck frame is made of a single piece of standard shape angle iron bent into the shape of a U, and is cross braced at the back under the compressor. The rear axle is a piece of square steel bolted directly to the frame. The compressor bed-plate bolts to the frame at each corner. The reservoirs rest upon angle iron supports, and are held firmly in place by means of wrought iron straps bolted to the frame. A very simple switchboard is placed between reservoirs and compressor, upon which the governor, fuse blocks and switch are mounted. The position of the governor renders it easily accessible for adjustment and maintenance. There is ample room to open the commutator door and examine the brushes. The compressor cylinder head can be removed and the pistons taken out without disturbing the balance of the apparatus.

If it is ever necessary, the gear case cover can be removed by first removing one of the rear wheels, which is easily accomplished. All oil fittings are easily accessible. The rear wheels are 18 ins. in diameter, and the front wheel 8 ins. in diamater, and the latter can be turned through an angle somewhat greater than 180 degrees. The handle is bent so that when it lies back between the reservoirs, the end of it will not protrude above the other apparatus on the truck. When two reservoirs are used, they are drilled symmetrically so that if removed, either one can be put back on either side. The width of the outfit is such that it can be run through aisles 31 inches wide, and its height is such that it can be stored under a bench if desired. The disposal of the apparatus on the truck brings about two-thirds of the weight on the rear axle.

The type shown in this illustration can be varied in arrangement to suit conditions, and the truck furnished with roller bearings if preferred.

### AUTOMATIC GREASE CUP.

A company has been formed in Peterboro, The Peterboro' Lubricator Mfg. Co., Ltd., for the manufacture of a new automatic compressed steel grease

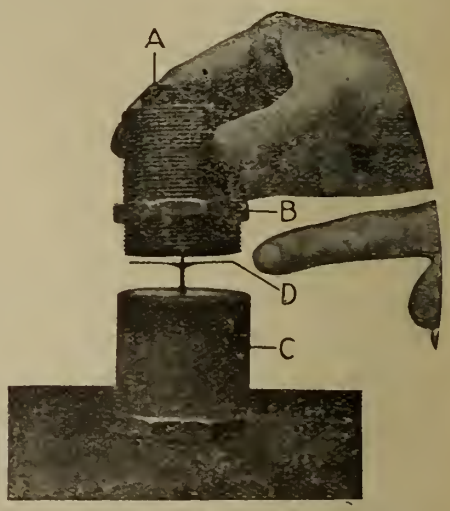



Fig. 1—Before Filling.

cup. It was invented by John F. Lewis, Philadelphia, who sold his Canadian rights to the new company. The cup is fitted on the bearings and works automatically by compressed air.

The method of filling the grease lubricator is as follows:

Screw the cup into place before filling, making sure that it is tightly screwed down, particularly on crank pins, or

Fig. 2—Cap Filled.

where there is unusual shaking. Unscrew and remove A; fill C even full with grease. There should be no grease at all in part A. Holding A as per Fig. 1, (with locknut B and disc D in

the positions shown), screw it into C to the position illustrated in Fig. 2; or not to exceed one-quarter of its length.

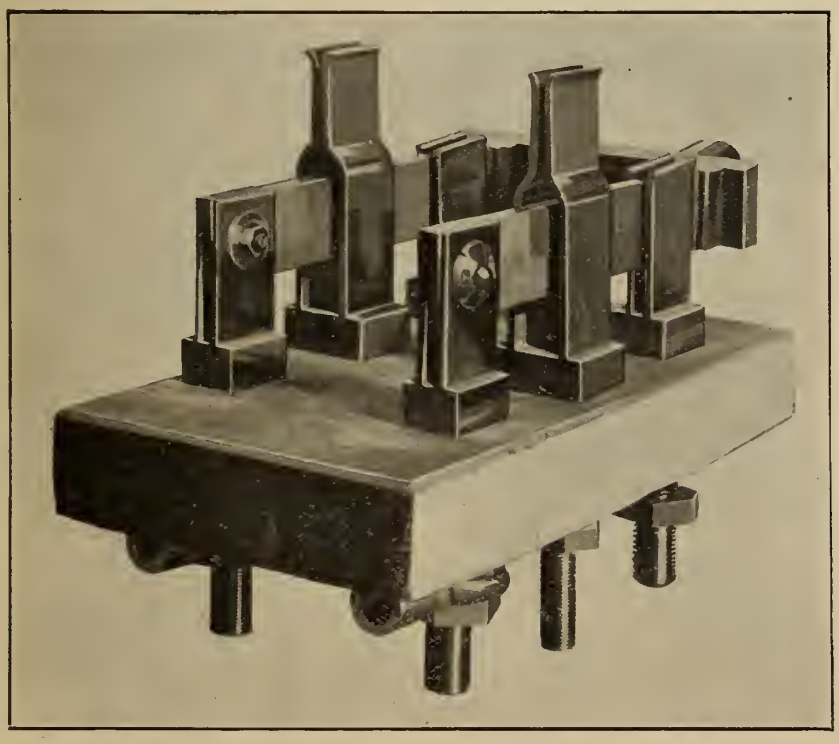
Fig. 2 shows cup filled with grease, the upper part screwed into place. This will suffice for a run of from one week to a month, depending on the nature of the journal. In the bottom of the cup is a funnel, which draws the grease to the centre so that if the grease in the cup runs low and the cup cannot be at once filled, the surplus in the funnel will be sufficient to lubricate the journal until the refilling is done.

## CONTACT SWITCH.

Illustrated herewith is a new switch which is just being prepared for the market, containing some distinctive features. These are the supplementary or discharge clips. The cut shows the switch in the closed position when the blades are free of discharge clips. Contact with these latter, however, is made on opening and circuit is broken from these supplementary points.

On opening the switch the field of a machine is shunted by means of these clips through a resistance which gradually absorbs the current and thereby prevents injury to field by relieving it of the inductive kick resulting from the sudden opening of the circuit. For motor work in connection with resistance or auto-transformer this switch provides a very effective and a cheaper starting device than regular controller or auto-starter. It also allows two sets of fuses to be used and does not require the operator to go through the unnatural action of completely closing, opening, throwing over to extreme opposite position and again closing in order to change from starting to running position.

This switch is being built up to 300 amp. capacity by the Hill Mfg. Co., 1560 St. Lawrence Boulevard, Montreal.



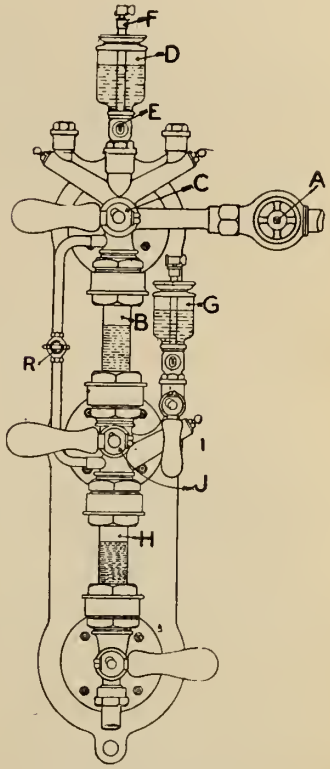
New Hill Contact Switch.

## SARCO FEED-WATER ANALYZER.

The "Sarco" Analyzer serves to determine at any time, and in a few moments the exact quantity of soda necessary from day to day to keep boilers free from scale. The apparatus is erected in the boiler house or engine room, in fairly close proximity to the boilers. So that water may be obtained from the boiler at any time, a permanent connection is made to the lower end of the water gauge, and a half-inch pipe run to the analyzer, the connection being there made to the cock A, shown in the illustration.

When it is desired to make an analysis of the water in the boiler, in order to ascertain whether the correct quantity of soda, to prevent scale, is being added, a certain number of drops of a special reagent are first admitted into glass B through the two-way cock C, set accordingly; the reagent being contained in the receptacle D, whose outlet E is controlled by the thumbscrew F. The number of drops may be easily counted at E.

The position of cock C is now reversed, so that the passage from D is closed, and the water inlet opened. Cock A is then turned on carefully, and a sample of feed-water admitted to glass B. filling it to the mark thereon. The




Sarco Feed-water Analyzer.

water will be colored by the reagent contained in the glass.

Next, the prescribed number of drops of a second reagent, which is contained in the receptacle G, is admitted into the lower glass H. through cocks I and J. The position of the latter is now reversed, the air vent R opened, and the sample of water passed down into glass H. Here the second reagent destroys the color-reaction previously produced. The number of drops required to bring about this result, shows whether the correct quantity of soda was contained in the sample, and, therefore, in the water in the boiler. Until this has been determined, the tests are made twice daily; later it will be found sufficient to perform an analysis two or three times a week. With the instrument is supplied a special form of salinometer, which shows when each boiler should be blown off.

The apparatus is being placed on the U. S market by the Sarco Fuel Saving & Engineering Co., West Street building, New York. Messrs. Sanders, Rehders & Co., Ltd., 108 Fenchurch St., London, E.C., England, have control of the Canadian market.

# Steam Boiler and Furnace Smoke Prevention Device

## Cornell Economizer Company Install a Patented Device for Smoke Prevention and Economy of Fuel in an Ontario Power Plant.

By G. CAMPBELL

A successful test of a fuel economy device was made in the power plant of the mill of McCann-Knox Milling Co., corner Jarvis Street and Esplanade, Toronto. The primary object, saving coal by proper combustion, was demonstanly and uniformaly to a cherry red. smoke.

The test was carried on at the instigation of Property Commissioner Harris, Toronto, and was witnessed by the

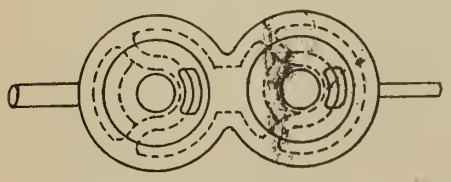


Fig. 2—Plan of Base.

Smoke Committee of the Canadian Manufacturers' Association, headed by E. Freysing. It costs from $12 to $15 per horse power to instal.

The Cornell Economizer is based on the fact that, when steam is heated to a sufficiently high temperature it is decomposed or broken up into its component parts of hydrogen and oxygen, becoming thereby a fixed gas or mixture of gases, one of which is an intense producer of heat and the other an active supporter of combustion.

To accomplish this, a small quantity of steam at boiler pressure is made to pass through a series of cast iron retorts containing annular spaces, and which are placed in the combustion chamber of the furnace, where they are heated constantly and uniformally to a cherry red. Here the steam is dissociated into its elements and the product (a fixed gas or mixture of gases) is passed through a gas and air injector, which is regulated to admit the proper amount of air for the complete combustion of the coal, into the closed ash pit. Pure gas is injected over the fire to prevent the formation of smoke. The oxygen unites with the carbon in the fuel, forming carbonic oxide gas, which, with the hydrogen and air, rises through the fire and burns around the boiler, forming carbonic acid gas and water vapor. These actions produce a condition in the furnace most favorable to the complete combustion of the fuel, and hence the economy.

The perfection of combustion realized

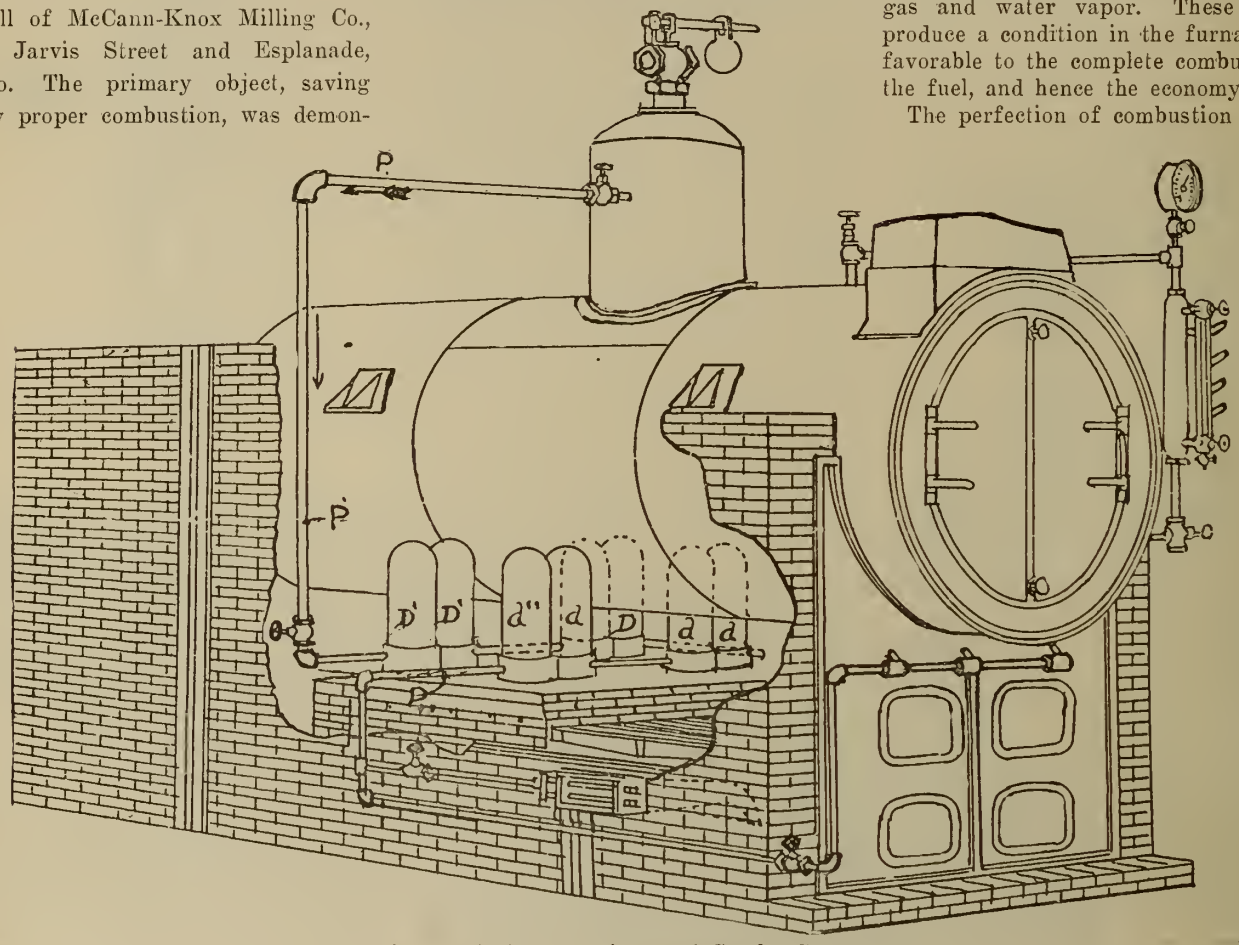



Fig. 1—Fuel Economizer and Smoke Consumer.

with our system is not the only advantage derived. With the use of either anthracite or bituminous coal, long

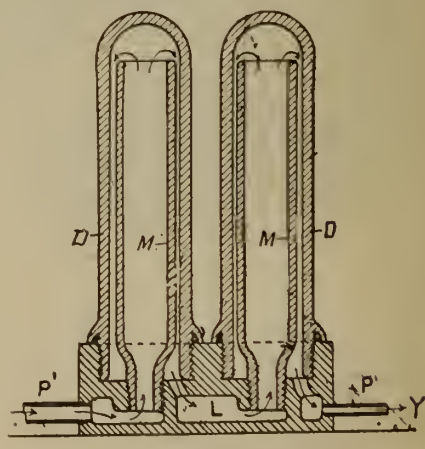



Fig. 3—Nest Retort.

flames of burning gases are produced which envelop the boiler, equalizing the work done throughout the entire heating surface, thereby rendering the surface more efficient and avoiding unequal expansions and contractions of the plates. By the use of our device the heat is so uniformly distributed throughout the boiler that there is no liability of the water being lifted off the sheets.

The retorts were installed by Mr. Cornell, of the Cornell Economizer Co., Philadelphia. The boiler was built at Polson's Iron Works, and is 150 h.p. capacity. There are six retorts under the boiler. The fuel is soft coal screenings.

Fig. 1 shows the arrangements of the retorts. Fig. 2 is a plan of the base. The

*Record of Observations Taken on 2-125 H.P. Horizontal Return Tubular Boilers Fitted With Cornell Fuel Economizer. Record Gives The Observed Results Before and After Installation of Economizer. Water Measured By Worthington Hot Water Meter; Coal Weighed. Economizer Consists of Twelve (12) C.I. Retorts Under Each Boiler, Placed in Rear of Bridge Wall. Temperature of Furnace Not Ascertained; Visual Examination Indicated Approximate White Heat.*

| | Without Economizer | | | | | | With Economizer. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Date of Run | Feb. | 18 | 19 | 20 | 21 | Average | Mar 9 | 10 | 11 | 12 | 13 | Average |
| Duration of Run | Hrs. | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Steam Pressure at Gauge. | Lbs | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| Temperature of Feed Water | Deg. | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| Total Coal Consumed as Fired. | Lbs. | 9000 | 9750 | 11250 | 10500 | 10125 | 9600 | 8550 | 8250 | 9000 | 9000 | 8880 |
| Total Ash | Lbs | 600 | 640 | 800 | 700 | 685 | 450 | 350 | 300 | 400 | 325 | 365 |
| Percent of Ash. | | 6.67 | 6.56 | 7.11 | 6.67 | 6.76 | 4.69 | 4.09 | 3.64 | 4.44 | 361 | 4.11 |
| Total Combustible. | Lbs | 8400 | 9110 | 10450 | 9800 | 9190 | 9150 | 8200 | 7950 | 8600 | 8675 | 8495 |
| Coal Consumed per Hour | Lbs | 818.18 | 886.36 | 1022.73 | 954.54 | 920.40 | 872.72 | 777.27 | 750.0 | 818.18 | 818.18 | 807.27 |
| Combustible Consumed per Hour | Lbs | 763.63 | 828.18 | 950 | 890.91 | 858.18 | 831.82 | 745.45 | 722.73 | 782.82 | 788.63 | 774.29 |
| Total Water Evaporated at Working Press | Lbs | 88330 | 89936 | 94653 | 90498 | 90854 | 132735 | 152571 | 169272 | 170956 | 176419 | 160390 |
| Factor of Evaporation. | | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 | 1.0513 |
| Water Evap'd. Per Lb. Coal at Working Press | Lbs | 9.81 | 9.22 | 8.41 | 8.62 | 9.01 | 13.82 | 17.84 | 20.52 | 18.99 | 19.60 | 18.13 |
| Equiv. " " " " From and At 212 | Lbs | 10.31 | 9.69 | 8.84 | 9.06 | 9.47 | 14.5 | 18.75 | 21.57 | 19.96 | 20.61 | 19.08 |
| " " " " Combustible | Lbs | 11.04 | 10.37 | 9.51 | 9.71 | 10.15 | 15.21 | 19.56 | 22.38 | 20.88 | 21.38 | 19.88 |
| Coal Burned per H.P. per Hour | Lbs | 3.35 | 3.56 | 3.91 | 3.81 | 3.66 | 2.27 | 1.84 | 1.71 | 1.73 | 1.70 | 1.85 |
| Commercial H.P. Developed. | H.P. | 244.5 | 248.96 | 261.71 | 250.67 | 251.46 | 395.38 | 422.14 | 498 | 473.25 | 488.66 | 455.48 |
| " " Rating of Boilers | H.P. | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| Percent of Rated H.P. Developed | | 98 | 99.58 | 104.44 | 100.27 | 100.57 | 158.01 | 168.84 | 199.2 | 189.30 | 195.48 | 182.16 |

table is a test of twenty-four retorts placed under two 125 h.p. boilers.

## CITY SUPERVISION OF NEW BOILER PLANTS.*

By Paul P. Bird.

Smoke prevention has become so important and necessary a work in the larger cities where soft coal is chiefly used that carefully planned organizations and well thought out policies are required to handle the work successfully.

A city cannot simply pass a smoke ordinance, appoint a smoke inspector and then sit still and expect the atmosphere to clear up. The proper enforcement of a smoke ordinance means that citizens must be stopped from doing something which they have always considered that they have a perfect right to do

To have a clean chimney when burning soft coal means: first, a carefully designed plant, with particular attention paid to the furnace and other parts that affect its smoke-making characteristics; and, second, the plant must be carefully operated.

Some people believe that they have a perfect right to put in any sort of a boiler furnace that they may fancy, but when the subject is carefully considered and the importance of the smoke problem realized, another conclusion is reached. For years city governments have controlled the erection of certain classes of building within fixed fire limits; they have made and enforced building ordinances which have insured that buildings were strong enough to support the designed load, and have insisted on numerous regulations for fire protection. Similarly regarding sanitary arrangements. Health officers have enforced rules providing for healthful and sanitary equipment in new buildings.

### Chicago's Smoke Ordinance.

In view of this, the city council of Chicago, about one year ago, passed a smoke ordinance which provides that the plans and designs of all new plants or the instalation of old plants for producing power or heat must be approved by the smoke inspector before the work of instalation or repairs is commenced.

It further provides that the smoke inspector must issue a permit for each job. This permit signifies the approval of the design for the furnace, breeching and stack. The permit, for which a fee of $2 per plant (not per boiler) is charged, is issued when the drawings are presented and before the work is started. After the work has been finished, but before the boilers are started up, a representative of the smoke department inspects the work to see that it has been done in accordance with the plans passed upon, and a certificate allowing operation is issued.

It is not an easy task to pass on drawings as outlined above. It requires a well-informed engineer to do it and a man who is eminently fair minded and honest .

### Smoke Economizers.

There is another phase of the question which is of great service to the citizens. There are on the market to-day a great many so-called smoke devices which are merely make-shifts and possess no particular value. The layman who is not an expert engineer but merely a business man, is at the mercy of the salesmen of smoke burners, preventers or devices, as the name may be. A city official who must give his approval of new instalations, can save the citizens from foolishly spending their money for something which is not worth what the salesman claims for it and which will not do all that the salesman represents.

*Abstract of a paper read at the third convention of the International Association for the Prevention of Smoke.

## LOST

Yesterday, somewhere between sunrise and sunset, two golden hours, each set with sixty diamond minutes. No reward is offered, for they are gone forever.—Horace Mann.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## E idences of Industrial Revival.

While conditions in the industrial world may not be entirely favorable at present, Brantford manufacturers are agreed that there is every prospect of improvement. Moreover, it is the opinion of nearly all that the better times will come in the immediate future. In a place like Brantford, which is essentially a manufacturing centre, prosperity is dependent on prevailing industrial conditions. In general, the situation is on the mend, and the anticipated good yield in the west this fall will aid materially, as Brantford's industries are so closely allied with western agriculture.

The situation in regard to mining in British Columbia is of the best. Every week news comes from the Kootenay of strikes on old properties. This shows that there is good value in the ground, but is more important as it indicates that steady work is being done, and this means a basis for general business. In connection with mining, Percy Williams, manager of the Boston Pioneer Development Co., will have a new and large dredge built for gold saving operations on the Fraser River, at Lillooet, showing that no part of the resources of the province is being overlooked.

Never in the history of the Nova Scotia Steel & Coal Company were the prospects for a prosperous year so bright as at the present time. The prediction made at the beginning of the season for a banner year in the output of coal has even now exceeded the most sanguine expectations. No doubt the securing of the contracts with the Elder-Dempster steamship line assisted in swelling the shipments of the company's output. At any rate, there is not a pound of coal banked by the company, and according to the outlook it will be some time before any quantity is piled up. An idea of the vast amount of coal raised may be gathered from the fact that for the past eight months no less than twenty-five thousand tons of coal have been taken from the different collieries of the Nova Scotia Steel & Coal Company, more than was raised for a similar period in 1907, and this, too, in view of the fact that last year was a record one for the company.

## General Manufacturing News.

A 90 h.p. producer gas power plant has been installed in the Deseronto waterworks. The pump is direct connected to the engine.

The Gurney Foundry Co., Toronto, is feeling the effect of the increased building operations and their factory is now working to its full capacity.

The Watson-Stillman Co., New York, manufacturers of hydraulic jacks, presses, etc., have appointed Alfred Collyer & Co., Montreal, Canadian agents.

The Marconi Wireless Telegraph Co. have recently placed an order with the Robb Eng. Co. for a 75 h.p. Robb-Armstrong engine for their Glace Bay station.

The Canada Metal Co., Toronto, is erecting a 60x200 feet brick and steel addition to their works, at a cost of $15,000. The large increase in trade has necessitated larger quarters.

Four Peterboro' gentlemen of large industrial experience have formed themselves into a syndicate to acquire and operate the business and plant of the William Hamilton Manufacturing Company, boiler, sawmill machinery, turbines, etc., at that place, now owned by the A. R. Williams Co., Toronto. If the property cannot be got at a reasonable figure from the latter, the syndicate will erect and equip new buildings and carry on a similar line of manufacture.

## Waterworks and Sewerage News.

A successful test was made of Ottawa's new waterworks pumps recently. The contract for the pumps was awarded last winter to the Chaudiere Foundry & Machine Co., which sublet it to Glenfield Kennedy & Co., of Kilmarnock, Scotland. The price being $30,500.

Superintendent Madison, Vancouver, has reported to the Civic Water Committee that the water mains in certain parts of the city are beginning to show the effects of electrolysis, through the leaking of the current from the rails of the tramline. A similar condition of affairs had prevailed two years ago, but the British Columbia Electric Railway Company had bonded its rails to the mains at many points, which had abated the trouble. In the last two months, however, it has again appeared.

The Calgary City Council has accepted the tender of John Gunn & Son, Winnipeg, for work on a gravity waterworks system, one of the greatest improvements ever attempted in the city. The tender was $156,195, which includes work on the pipe line and excavations, complete from intake to reservoir, a distance of over 10½ miles. The lowest tender was that of F. F. Fry, of Moose Jaw, at $153,360. The next highest was that of the Redwood Manufacturing Co., of San Francisco, at $172,000. The cost estimated by Consulting Engineer Mitchell was $204,080.

## News of Electrical Undertakings.

Orillia's municipal power plant is now completed by the finishing of the new dam at Ragged Rapids.

The contract for constructing the Pipestone, Man., municipal telephone system has been secured by John Reid.

George Collison will receive a franchise and a bonus towards erecting a new electric light plant at Killarney, Man.

Strathcona city council will extend the electric power system to the Alberta Farmers' Association's grain-cleaning plant.

The contract for the construction of the Argyle municipal telephone system has been awarded to Playfair Bros., Baldur, Man.

Nelson, B.C. is voting on a by-law to raise $85,000 for the addition of a second unit to the civic electric lighting and power plant.

The Winnipeg Street Railway Company has made an offer to the City Council to furnish that city with ten thousand horse power for ten years at $18.40 per horse-power per annum.

The water commissioners of Lindsay have decided to instal an electric pump instead of a steam one for the pumping of its water supply.

The Light, Heat & Power Co., of Lindsay, offer to instal electric energy in the waterworks pumping house at a saving of $500 annually over steam.

Stratford is raising an objection to the signing of the Hydro-Electric contract. As that city figures it, the cost would be $53.37 per h.p. per annum.

The Ontario Power Co. is negotiating with the Westinghouse Co., of Pittsburg, for the purchase of a generator and switch board to cost $70,000.

The electric light station at Brockville, Ont., owned by the corporation of Brockville, was burned recently. Loss on buildings and machinery, $10,000.

In connection with the Galt Electrical Manufacturing Company, the Lyons Electrical Company, of Brantford, is installing a large generator at Burford.

Winnipeg city council has voted a further sum of $22,000 for the civic power scheme. The money will be expended on necessary work before the winter sets in.

The Bell Telephone Company have recently completed a new line out the Eramosa road, from Guelph to Everton. This will give a more direct phone service from Guelph to Erin and Orangeville.

Arrangements are now being made to put a by-law before the ratepayers of Fernie, B. C., to provide sufficient money to rebuild and operate the Crow's Nest Electric Light & Power Company's system as a municipal enterprise.

The authorities of Glace Bay, N.S., are installing 400 meters in connection with the municipal electric light plant, and are also adding about three miles of transmission lines to the system.

The City Electrical Supply Co. has been formed at Wetaskiwin Alta., by N. D. Farris and R. C. Talbot, entering into partnership. The company will handle a full line of everything required in the electrical line.

The Winnipeg city council is considering the instalation of a patrol system. The system complete it is estimated will cost $250,000, but the present requirements will call for an expenditure of only about $60,000.

A company is being organized at south of Estevan, Sask. to construct a rural telephone system with 11 miles of wires to be strung this fall and more added in the spring. Connection will be made with Estevan by a long-distance line.

The Kingston city light department is figuring upon the electric lighting of Portsmouth, and there is a possibility that arrangements will be made with the village council about extending the city system into the village, providing the service will pay.

Regina is considering the securing of cheaper power by the erection of a power house at the Dirt Hills, about sixty miles from the city, where there is said to be an abundant supply of excellent soft coal, and transmitting the power to the city by electric cables.

Wynn-Meredith, the consulting hydraulic engineer, has completed a survey of the Jordan river, on Vancouver Island, for the B. C. Electric Railway, which company has made an appropriation of $1,500,000 to establish a power plant when a suitable location is fixed upon.

The Ontario Distributing Company is about to extend its lines in Stamford Township, Ont., to the marsh winery. It is supplying 100 h.p. to the Town of Niagara for lighting and for power at the waterworks, and is furnishing private lighting. The Queen's Royal has put in about 600 lights.

At a meeting held at Simcoe, Ont., to consider the telephone service, it was the concensus of opinion that too high charges were being paid for telephones, and that the rural telephone line should be extended without delay. A telephone company was formed and directors appointed.

One of the largest coal pockets in Canada is now under construction at Mile End, Montreal, for Hartt & Adair. It is of reinforced concrete and is one of the most modern design, being the first of its type to be built in Canada. It will have a capacity of 6,000 tons of coal, all stored overhead.

R. H. Parkinson, C.E., is engaged with a party of men on the north fork of Mission Creek, B.C., in surveying a storage area and selecting a reservoir site. It is understood the plans of the syndicate include the development of water power and the building of an electric tramway to Kelowna, B.C.

To meet the contract with the Hydro-Electric Commission the Ontario Power Co. has decided to add two units to its present plant of six units at Niagara Falls. The contract for the extension to the power house has been let to H. .D. Symmes. The addition will add 25,000 horse-power to the capacity and will make a total of 95,000.

The British Columbia Electric Railway Company will this year enter upon an extensive programme of improvements in connection with the water power operating its Lake Beautiful generating plant. A large dam will be built at the mouth of Lake Coquitlam, at a cost of $250,000, and another electrical unit of 10,000 h.p. will be installed.

The tender of the Canadian Westinghouse Co. was accepted for the lighting apparatus for the streets of Prince Albert. The outfit consists of fifty arc lamps, cut outs, regulating transformers, arresters and other supplies. The contract figure was $3,154.60. Fifty 12-foot mast arms will also be purchased from the Canadian General Electric Co. at $6.80.

A building permit has been issued at Victoria to the British Columbia Electric Co. which will add a storage and battery room to its present building on Store Street. The addition, which will cost $4,000, will be fitted up with the necessary appliances for storing electricity. At present there is considerable waste of power which, with the appliances to be installed, will be conserved.

The Ontario Power Company, Welland, is arranging to add two units to its present plant of six units, and the contract for the extension of the power house has been let to D. H. Simms. The extension will be one hundred feet long, and work will go on night and day to have it completed by December 1st. This will add 25,000 horsepower, making a total of 95,0 0

which the Ontario Power Company will have for use.

The Lethbridge city council have instructed Smith, Kerry & Chace, consulting engineers, Toronto, to design and construct a steam-electric generating station, which will involve the use of certain elements in the old station which has recently been purchased by the city from the Lethbridge Electric Company. The new station will be equipped with approximately 1,000 k.w. machinery, including steam water pumping unit, coal-handling apparatus, etc.

A syndicate, composed of Toronto, Ottawa and Montreal interests, has been granted the privilege of developing the large water power at Raven Lake, which is some three miles south of Larder Lake. Surveys and plans are being prepared, and J. Samson Handley, of New Liskeard, has been retained as consulting engineer for the scheme. It is thought that several thousand horse-power can be generated from these falls, and the general outline of the scheme is to convert the power into electrical energy with a view of transmitting it to the various mines at Larder Lake on a high tension pole line.

The North Bay, Ont., Light, Heat and Power Company have submitted to the council a proposition in which they ask for a 20 years' franchise, three years of which to be exclusive, and that they furnish light, while by steam power at the rate of 15 cents, and 20 per cent. off. Or should they be able to run by water power, they supply light at 15 cents, with 20 per cent. off, and a further discount of 10 per cent. if paid within 20 days, and a still further discount of 5 per cent. if paid within 10 days. A meter charge of 25 cents per month in any case. Should this proposition fail to meet with the approval of the council, the company offers to sell the plant, including the gas plant, to the town for the sum of $75,000.

## Companies Incorporated.

The Electrical Fittings Co., Toronto; capital, $40,000; to manufacture and deal in electrical supplies and fittings. Provisional directors, A. C. B. Jones, A. C. McMaster, Lena Duff and Violet W. Jenner, all of Toronto.

The London and Western Counties Pipe Line Co., London; capital, $1,000,000; to develop natural gas and oil fields. Provisional directors, F. G. Rumball, W. Scarlett, W. J. Teasdall, T. E. Robson, H. W. Ansley and A. A. Campbell, all of London.

## Pine River Power Co.

H. H. Hastings, representing the Pine River Power Co., is promoting a scheme to develop the Huxtable water power, near Horning's Mills. Power will be furnished to Shelburne, Orangeville and Grand Valley.

## Gas Motor Competition.

At a meeting of the executive committee of the Winnipeg Industrial Exhibition Association, it was decided to continue for another year the light agricultural motor competition that was held at the late exhibition for 1909, and it is the present intention to widen the scope of machines that are able to enter the competition by making more classes, the details for which have not yet been worked out, but will be gone into and manufacturers notified early this fall as to the date of the fair next year, and the conditions with the classification of the competition. A. W. Bell, Winnipeg, Manitoba, Canada, is manager of the association.

## Largest Elevator in Canada.

The largest hydraulic elevator, with the greatest lifting power of any in Canada, is being installed at present at Quebec City by the Quebec Ferry Co. This company some time ago gave instructions to the Parkin Elevator Co., Hespeler, Ont., to build and instal a five-plunger hydraulic elevator with a capacity of lifting two hundred and ten tons to the height of 18 feet. The elevator will be required to lift cars from the ferry and place them on the level of the tracks above. The trunks required will be 40 feet long by 16 feet wide and seven tons of steel will be necessary in its construction. The total amount of iron used in the construction of the entire elevator will be over one hundred tons. Already the work of instaling has rapidly advanced and in a short time will be completed.

## Power Tenders.

The tenders for apparatus for inter-switching and transforming the electric current to be brought from Niagara Falls have been opened by the members of the Hydro-Electric Power Commission, and it was stated that the cost of this portion of the equipment of the Government transmission system would be considerably below the estimate of $1,107,000, made by the Commission's engineers. The contracts to be awarded are for the equipment of the transformer stations and the step-up station at Niagara Falls.

The stations will be twelve in number, and will be built at the following points: Niagara Falls, Dundas (combined transformer and interswitching), Toronto, Brantford, Woodstock, London, Guelph, Preston (supplying Galt and Hespeler), Berlin (supplying Waterloo and New Hamburg), Stratford, St. Mary's and St. Thomas. Stratford and St. Mary's will depend upon the passage of the Stratford by-laws.

## Gas Engine Experiments.

A suction gas engine is being tried aboard H.M.S. Rattler, an obsolete warship. The advantages claimed for the suction gas engine are that no stokers are required and that cheap coal can be used, while with an equal amount of coal consumption 50 per cent. more power is obtained than by a steam engine. The gas is prepared by passing steam and air through a furnace in which coal or coke is burned, and the gas thus produced, after being cooled and cleaned by passage through the scrubber filled with damp coke, is sucked off by the engine just as it is required for driving it. In this way only so much gas as is wanted to feed the engine is produced. The suction gas engine is said to need neither boilers nor funnels. The stokehold of the Rattler is described as a huge, airy compartment with two or three great upright cylinders in it, not at all hot, but clean and free from the usual objectionable concomitants of stokeholds. The Rattler's engine is only in the experimental stage, but the old vessel was driven by a 50 horse-power engine at a rate of nearly eleven knots an hour at a cost of 6 cents per ten miles.

## B.C. Electric Ry. Improvement.

The contract was awarded recently by the British Columbia Electric Railway Company for the instalation of a turbine water wheel at the Lake Buntzen generating plant, the capacity of the equipment being 11,000 h.p. The John McDougall Company, of Montreal, secured the contract, and the new wheel will be the Doble type, a class of turbine equipment.

The award of the contract forms part of the company's scheme for increasing the supply of power from the North Arm plant, the ultimate cost of this scheme along being $300,000. Involved in the plan is the extension of the stone building housing the hydraulic equipment for about 60 feet and the instalation of generating machinery capable of turning out 10,000 horse-power of electrical energy. To run the equipment two additional pipe lines will be laid from the Lake Buntzen dam to the powerhouse.

## World's Production of Coal.

E. W. Parker, the coal expert and chief statistician of the U. S. Geological Survey, estimates the world's production of coal for 1907 at 1,209,184,109 short tons, of which the United States furnished 39.7 per cent. Comparing the quantities as reported to short tons of 2,000 pounds each we have these figures:

| | Short tons. |
|---|---|
| United States (1907) | 480,363,424 |
| Great Britain (1907) | 299,970,677 |
| Germany (1907) | 226,773,605 |
| Austria-Hungary (1907) | 43,955,315 |
| France (1907) | 40,708,215 |
| Belgium (1907) | 26,261,745 |
| Russia and Finland (1906) | 23,857,961 |
| Japan (1907) | 15,362,467 |
| India (1906) | 10,957,240 |
| Canada (1907) | 10,510,961 |
| New South Wales (1906) | 8,541,525 |
| Spain (1906) | 3,620,588 |
| Transvaal (1907) | 3,261,533 |
| New Zealand (1906) | 1,937,080 |
| Natal (1905) | 1,264,995 |
| Mexico (1906) | 846,416 |
| Queensland (1907) | 765,265 |
| Holland (1906) | 587,283 |
| Italy (1906) | 521,711 |
| Sweden (1906) | 327,361 |
| Victoria (1906) | 179,907 |
| Cape Colony (1906) | 142,877 |
| Tasmania (1907) | 65,958 |
| Other countries | 8,400,000 |
| Total | 1,209,184,109 |

## Helen Iron Mine Electrical Equipment.

The Lake Superior Power Co. has gone into an extensive scheme for the improvement of the Helen Iron Mine, in West Algoma. It will be of the most modern character, using electricity wherever feasible. A large part of the plant operated by steam will be adapted to motor drive.

The Algoma Power Co. will instal a hydro-electric plant on the Michipicoten river, where there is a fall of 128 feet to furnish the necessary power. The power unit will consist of a 1,000 h.p. single horizontal turbine water wheel, direct connected to a 600 k.w. direct current generator connected to a h.p. turbine. Transformers will reduce the current from 10,000 volts to 600 volts.

In the application of this power the mining company will use a 150 h.p. induction motor to drive one of its large mining hoists, a 60 h.p. induction motor to drive one of the smaller hoists, one 85 h.p. induction motor to drive its Gate "K" crusher, and a 15 h.p. motor of similar design in the machine shop. Compressed air for drilling will be supplied by a 16½x18 air compressor driven by a 200 h.p. induction motor. Water will be pumped by one 4-inch single-stage turbine driven by a 30 h.p. motor and another 2-inch two-stage turbine, driven by a 7½ h.p. motor.

The contracts for the entire electrical equipments for both these instalations, as well as for the air compressor and pumps have been awarded to Allis-Chalmers-Bullock, Limited, of Montreal, manufacturers of complete hydro-electric plants.

## CATALOGUES.

FIRE BRICK.—A talk on fire brick for boiler settings, from Harbison-Walker Refractories Co., Pittsburg, Pa.

POWER PLANT SPECIALTIES.—From Darling Bros., Montreal, catalogue of valves, oil separators, traps, pumps, etc.

GREASE CUP.—Booklet with a description of the Philadelphia Grease Cup and its use, from Peterborough Lubricator Co., Peterborough, Ont.

PUMPS.—Catalogue 71, from Dean Bros., Indianapolis, Indiana, describing and illustrating their full line of steam and motor-driven pumps.

NERNST LAMPS—Bulletin B, from the Nernst Lamp Co., Pittsburg, Pa., illustrating and describing the Westinghouse Nernst Multiple-Glower lamps.

PRESSURE PUMP.—Leaflets from Burke Machinery Co., Cleveland, Ohio, describing a new pressure pump designed for pumping pressure for testing valves.

ROPE TRANSMISSION.—From Jones & Glassco, Montreal, a well illustrated and written treatise on Transmission of Power by Ropes and the system used by William Kenyon & Sons, Limited, Dukinfield, England.

BELTING—Pamphlet and price list from D. K. McLaren Belting Co., 309 Craig Street, Montreal. Prices are given for oak-tanned, rubber, Balata and American duck beltings.

BELTING—Catalogue from Beardmore Belting Co., 39 Front Street East, Toronto, describing their belting, belt dressing and belt cement. Some valuable belt information is given which makes the catalogue valuable.

METERS—Reprint of paper read before the Northwestern Electrical Association on Warrantable Expenses for Meter Testing, from Canadian Westinghouse, Hamilton, being publication 7062.

AUTOMATIC STOKERS—A handsome catalogue on coated paper from the Detroit Stoker & Foundry Co., Detroit, Mich. The adaptation of their stoker to various types of boilers is illustrated and the various points of durability, accessability, etc., are discussed.

ELECTRICAL APPARATUS—Bulletins 1017, 1068 and 1155 from the Canadian Westinghouse, Hamilton, describing, respectively, induction type potential regulator, direct current motors and mercury rectifier, constant current regulating transformer outfit.

BELTING—From Durham Rubber Co., Bowmanville, Ont., illustrated catalogue of belting, hose, packing and rubber goods. Their line of belting for various methods is described with methods of splicing, also packings, valves and gaskets, giving prices.

## BOOK REVIEW.

GAS ENGINES.—By Jules de Clercy, C.E., 62 Ontario St. West, Montreal.

The book is written in French, and is a work on the gas engine giving the theory and practical sides, illustrated with plants installed in Montreal and the Province of Quebec. Some plants were abandoned and explanations are given the reason for this. He also points out the many successful ones and how gas plant installations are very economical when given the proper care.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non advertisers.**

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Dressings.
Stephenson Mfg. Co., Albany, N.Y.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
Canadian Fairbanks Co., Montreal.
Sadler & Haworth, Montreal.

### Boiler Cleaner.
Canada Chemical Mfg. Co., London.

### Boiler Feed Regulators.
Standard Engineering Co., Toronto.

### Boiler Mountings.
Standard Engineering Co., Toronto.

### Boilers.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Condensers.
Goldie & McCulloch Co., Galt.
Laurie & Lamb, Montreal.

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Driving Rope—Cotton.
Jones & Glassco, Montreal.

### Dynamos.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.

### Engines, Gas and Gasoline.
Gas & Electric Power Co., Toronto.
J. DeClercy, C.E., Montreal.
Jones & Glassco, Montreal.
W. H. Oliver & Co., Toronto.

### Engines, High Speed, Steam.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.

### Engines, Simple and Compound.
Waterous Engine Works Co., Brantford.

### Exhaust Heads.
Standard Engineering Co., Toronto.

### Feed Water Heaters and Valves.
Darling Bros., Montreal.

### Gas Producer Plants.
Canadian Fairbanks Co., Montreal.
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto.

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Hangers.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Heaters.
Goldie & McCulloch Co., Galt.

### Heating and Ventilating Apparatus.
Sheldons Limited, Galt.

### Indicators, Steam Engine.
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Mill Machinery.
Goldie & McCulloch Co., Galt.

### Motors.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Planimeters.
Jas. L. Robertson & Sons, New York.

### Plate Work.
Goldie & McCulloch Co., Galt.

### Power Pumps.
Goldie & McCullock Co., Galt.

### Power Transmission Machinery.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Pump Governors.
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Reducing Wheels.
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt.

### Shafting.
Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Union Drawn Steel Co., Hamilton.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Steam and Oil Separators.
Standard Engineering Co., Toronto.

### Steam Pumps.
Goldie & McCulloch Co., Galt.

### Steam Specialties.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.
Sheldons Limited, Galt.
Standard Engineering Co., Toronto.

### Steam Traps.
Sheldons Limited, Galt.

### Stocks and Dies.
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Switchboards, Light and Power.
Gas & Electric Power Co., Toronto.
Hill Electric Mfg. Co., Montreal.

### Switchboard Supplies.
Hill Electric Mfg. Co., Montreal.

### Switches, Electric.
Hill Electric Mfg. Co., Montreal.

### Tanks, Oil.
Goldie & McCulloch Co., Galt.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.

### Turbine Water Wheels.
J. C. Wilson & Co., Glenora, Ont.

Canadian Fairbanks Co., Montreal.
Jas. Morrison Brass Mfg. Co., Toronto.

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Venetian Grates.
J. De Clercy, Montreal.

### Watt Meters.
Gas & Electric Power Co., Toronto.

### Wood Split Pulleys.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.

## ALPHABETICAL INDEX TO ADVERTISERS


**A**

American Industrial Pub. Co ..... 45
American School of Correspondence ..... 43

**C**

Canada Chemical Mfg. Co ..... 7
Canada Machinery Agency ..... 5
Canada Metal Co ..... 6
Curtis & Curtis Co., The ..... 46

**D**

Darling Bros ..... 46
De Clercy, Jules, C.E ..... 45

**G**

Garde, John, & Co ..... 45
Gas & Electric Power Co ..... 2
Goldie & McCulloch Co ..... 8

**H**

Hill Electric Co ..... 45
Hall Engineering Works ..... 45

**K**

Kilmer & Pullen ..... 4

**L**

Laurie Engine & Machine Co., Ltd ..... 46
Laurie & Lamb ..... 44
Morrison Brass Mfg. Co., Ltd., Jas .... outside back cover

**O**

Oliver, W. H., & Co ..... 4
Owen Sound Iron Works ..... 46

**P**

Packard Electric Co., Ltd ..... 6
Penberthy Injector Co., Ltd ..... outside front cover
Phillips Electrical Works, Eugene F., Ltd ..... 34

**R**

Peterboro Lubricator & Mfg. Co ..... 7
Robertson, Jas. L., & Sons ..... 43

**S**

Sheldons Limited ..... 7
Sight Feed Oil Pump Co ..... 5
Standard Engineering Co ..... 5
Stephenson Mfg. Co ..... 44
Smart-Turner Machine Co ..... 45
Sadler & Haworth ..... 44

**T**

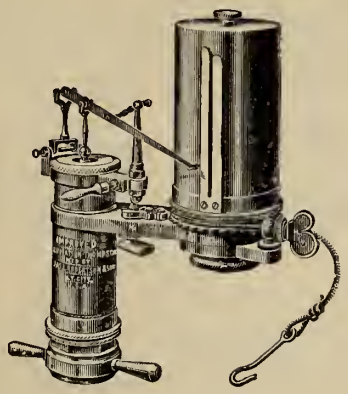
Toronto & Hamilton Electric Co ..... 46
Toronto Plate Glass Importing Co ..... 45

**W**

Waterous Engine Works Co ..... 1
Wilson, J. C., & Co ..... 45

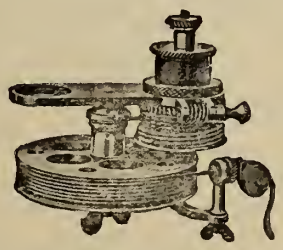

### A Great Producing Furnace.

The Hamilton Steel and Iron Company possesses one of the largest producing blast furnaces under the British flag. This is the new furnace which was installed some time ago at a cost of about $500,000. It has been in operation for some time and although not by any means the largest furnace in the matter of size it has wonderful producing qualities. The furnace was built so as to have a capacity of 300 tons of pig iron a day, but 400 tons a day is the minimum amount produced. At the present time one of the furnaces is undergoing repairs and as the company is feeling slightly, the general business depression, the plant is turning out only about 500 tons of pig iron a day. The Hamilton Steel and Iron Company is one of the busiest and one of the largest institutions of its kind in Canada and at present the company's ships are bringing down the last cargoes of the 256,000 tons of ore from the mines, which is calculated to fill the wants of the concern from the closing of navigation, about the end of December, until it re-opens. This immense quantity of ore amounts to over 5,000 carloads.



# The Robertson-Thompson Indicator

## And Victor Reducing Wheel



are invaluable to every engineer who sees the importance of keeping his engines running at the highest-efficiency, greatest-economy point—all the time.

This outfit is correct in design, principle and construction. Its records are perfect in accuracy and always reliable.

Any engineer can buy this apparatus and hardly notice the expense.

**Moderate in Price**
**Sold on Easy Terms**

**THE WILLIS PLANIMETER is the most perfect on the market.**

*WRITE FOR DETAILS*

**Jas. L. Robertson & Sons**
**38 Warren St., New York**

# The Platform of Success

**KNOWLEDGE IS THE PLATFORM OF SUCCESS**

A good, strong, educational platform is as essential to the business man, professional man or trade worker who aspires to success as the political platform is to the presidential candidate. The **new SIX VOLUME edition** of the

**CYCLOPEDIA OF**

## Applied Electricity

offers the electrical worker a **platform** on which he can make a **successful stand.** It contains 3,000 pages, 7x10 inches; numerous illustrations, diagrams, tables and formulas, handsomely bound in half red Morocco and carefully indexed for ready reference.

Every known electrical appliance is given special attention, every subject treated by an expert—written plainly and clearly. This wonderful Cyclopedia is authoritative, comprehensive, will give you the opportunity you desire, no matter if you are working at the bench or an experienced electrician.

The whole work is profusely illustrated with special drawings, diagrams, photographs, tables and formulas, supplemented with a series of practical test questions with solutions carefully indexed for ready reference. To introduce our Home Study Courses from which the Cyclopedia was compiled, we make this special

## FREE 5-DAY OFFER

Just fill in the coupon and we will send a set of these beautiful books absolutely FREE for 5 days' examination. If you find the books satisfactory, pay $2.00 within 5 days and $2.00 a month until you have paid the special $18.60 price; otherwise notify us to send for them at our expense.

**SPECIAL PRICE $18.60** **REGULAR PRICE $36.00**

Order promptly and we will include FREE for one year, as a monthly supplement, the

**TECHNICAL WORLD MAGAZINE,**

a live, up-to-the-minute, $1.50 monthly, crowded with special technical articles written in popular form and illustrated with scores of interesting photographs.

BRIEF LIST OF CONTENTS

Theory, Calculation, Design and Construction of Generators and Motors; Types of Dynamos and Motors; Elevators; Direct-Current Motors; Electrical Measurements; Electric Lighting, including Arc and Incandescent Lighting, Nernst Lamp, Cooper-Hewitt Lamp, Osmium Lamp, etc.; Electric Railways, including Third-Rail System, Multiple-Unit Control, Electro-Pneumatic Control; Alternating-Current Motors, etc.; Single-Phase Electric Railway; Electric Welding; Mercury Vapor Converter; Management of Dynamos and Motors, including the Location and Remedy of Troubles, such as Sparking at the Commutator, Heating, etc.; Power Stations; Central Station Engineering; Central Station Design; Storage Batteries, including Charging and Discharging, Troubles and their Remedies, Tests for Impurities, etc.; Power Transmission, Alternating-Current Generator, Synchronous Motor, Induction Motor, Transformer, Rotary Converter, Frequency Changer, etc; Electric Wiring, Electric Telegraph; Wireless Telegraphy; the Telautograph; Telephony, including Instruments, Lines, Exchanges, Common Battery Systems, Operation, Maintenance; Automatic Telephone; Wireless Telephony; Telegraphone, etc.

**AMERICAN SCHOOL OF CORRESPONDENCE**
**CHICAGO, U.S.A.**

**FREE OFFER COUPON**

*Fill in, clip and mail to-day.*

**American School of Correspondence:**

Please send Cyclopedia of Applied Electricity for 5 days' FREE examination. Also Technical World for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60; otherwise I will notify you and hold the book subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

POWER HOUSE—10—08

# SADLER & HAWORTH

## Oak Leather Belting

**WHEN A LEATHER BELT**

*is not satisfactory it is a costly nuisance. You cannot afford to make mistakes. You run no risk when you buy*

"CLIMAX"

STEPHENSON BAR BELT DRESSING

PRESERVES BELTS - PREVENTS SLIPPING

## SAMPLES SPEAK LOUDER THAN WORDS

Columbus, Ind., Aug. 11, 1908

Stephenson Mfg. Co., Albany, N. Y.

Gentlemen:—Some time ago you sent us a Sample of Stick Dressing for Leather Belts, which we have used, and find same all you claim for it, so we ask that you ship us by return express at least one dozen Sticks per Sample for Leather Belt.

Trusting you to make shipment at once, we are,

Yours very truly,

Fehring Carriage Co.

May we send YOU a Sample?

**RED Label Brand** for Leather belts;
**GREEN Label** for Rubber or Canvas.

No one kind of Dressing is good for all belts—you know that.

Of Dealers everywhere, or

STEPHENSON MFG. CO.
ALBANY, N. Y.

Your protection against substitution is **The Man with the Cog-Wheel Face** on each Pound Stick.

## MODERN EXAMINATIONS OF STEAM ENGINEERS

By W. H. WAKEMAN.

The fifty-three chapters of excellent reading in this book fully answer THREE HUNDRED practical questions about Engines, Boilers, Safety Valves, Belting, Shafting, Steam Heating, Boiler Bracing, etc. It is an excellent book of reference, especially written for Engineers and Firemen, and is UNIVERSALLY ACKNOWLEDGED as the BEST and MOST COMPLETE work on the subject.

THIRD EDITION NOW READY.

272 Pages. Fully Illustrated.

Price, $2.00, Postpaid.

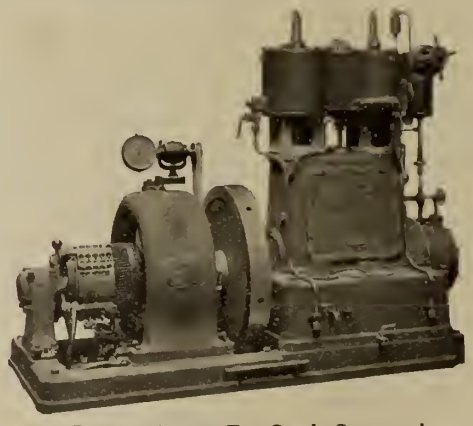
Maclean Publishing Company
Technical Book Dept.
10 Front St. East, - Toronto

Established over 50 years. Telegrams: "Belliss Birmingham." Code: "A B.C. 5th edition

# BELLISS & MORCOM LIMITED

## ENGINEERS

## Birmingham, - - England



Representing our Two-Crank Compound Type Engine.

# ENGINES

DIRECT, ROPE OR BELT DRIVE for

Electric Power Lighting, Traction and Mill Driving

ALSO

CONDENSING PLANTS

6,500 H.P. Installed in Canada

**ADVANTAGES** — Self-Lubrication; Simplicity; Strength; Experience; Low Cost; Reliability; Minimum Maintenance; Compactness; Good Governing; Durability; Maintained Efficiency; Quiet Running.

**3 800** Engines supplied or building, representing upwards of **650.000 H.P.**, in sizes ranging from **5 TO 2,700 B H.P**, of Compound and Triple-Expansion Types.

SOLE AGENTS FOR CANADA:

**LAURIE & LAMB, 211 Board of Trade Buildings**
**MONTREAL, CANADA**

Telegraphic Address. "Larco" Montreal. Codes: A.B.C. 5th Edition and Western Union.

TELEGRAPHIC ADDRESS
"HALLTYNE"

WORK
PHONE MAIN 256

## THE HALL ENGINEERING WORKS

14 TO 16 JURORS STREET, MONTREAL

ENGINEERS, BOILERMAKERS, BRASS & IRON FOUNDERS, COPPER SMITHS & BLACKSMITHS, SHIP REPAIRS A SPECIALTY

Agents for J. & E. Hall's Refrigerating Machinery.
Atlas Preservative Co. & United Asbestos Co.
of LONDON, ENG.

**THOS. HALL,** M. N. E. C. I. E. S. Phone West 1737
*Late Supt. Engineer Messrs. Elder Dempster & Co. & Can. Pac. Rly. Co., London*

**T. O. SINCLAIR,** M. I. M. E. Phone West 917

---

SET OF HAND BOOKS ON

## STATIONARY ENGINEERING

The following 7 books form an excellent set on stationary engineering, and should be in the hand of every engineer. They are the best we can recommend, and should be studied in the order named.

| | |
|---|---|
| Catechism of the Steam Engine | $2.00 |
| Hand Book of Calculations | 2.00 |
| Maxims and Instructions for the Boiler Room | 2.00 |
| The Engineers' Manual | 0.50 |
| Modern Examinations of Steam Engineers | 2.00 |
| Hand Book of Corliss Steam Engines | 1.00 |
| The Steam Engine Indicator and Its Appliances | 2.00 |
| | $11.50 |

Complete descriptive circulars of any of the above books sent free on request. Any one of the above books sent by mail, on receipt of price, or the complete set for *$10.00.* Send for Catalogue.

**THE AMERICAN INDUSTRIAL PUBLISHING CO.**
Publishers, Booksellers and Importers
Box M. Bridgeport, Conn., U.S.A.

---

## JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers

A Strand of Lead Wool coiled up for transit.

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

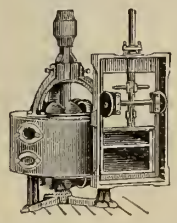
---

## OPAL GLASS TILING

FOR WALLS OF
MACHINERY AND POWER HOUSES
Most approved material.
TORONTO PLATE GLASS IMPORTING CO'Y
PLATE AND WINDOW GLASS
135 to 143 Victoria St., - Toronto

---

## Improved "LITTLE GIANT" TURBINE WATER WHEEL



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effiency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

Write for descriptive catalog.

## J. C. Wilson & Co.

GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.

---

## FOR YOUR SWITCHBOARD

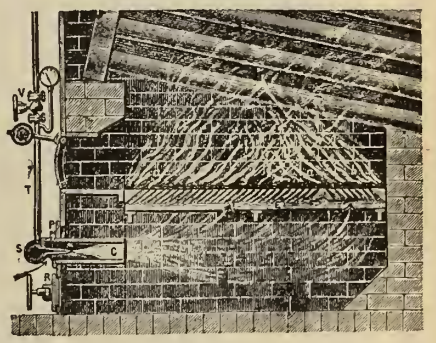
Cast Copper Terminal Lugs

We Manufacture Switches and Switchboards

Address: Power Department

HILL ELECTRIC MFG. CO.,
1560 St. Lawrence Boul. Montreal

---



## Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

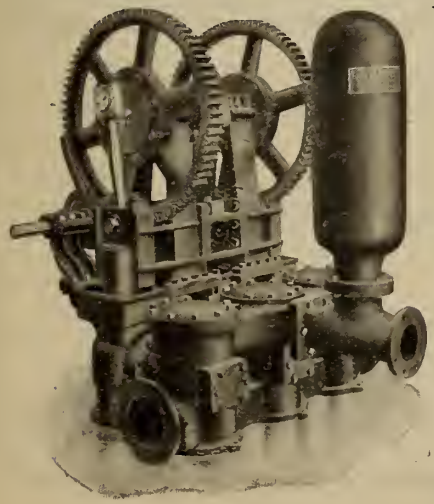
Saves 20% to 50% in your fuel bills.

*For Particulars Apply*

## J. de Clercy, C.E.

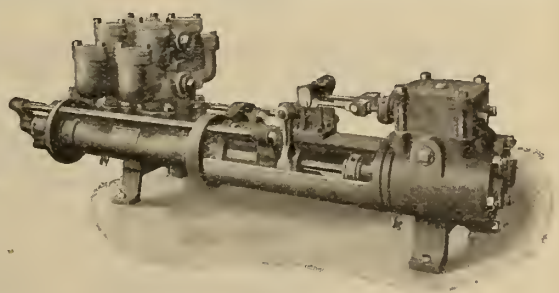
62 Ontario St., West
MONTREAL

---



The
## Smart-Turner
Machine Company, Limited
Hamilton - Ont.

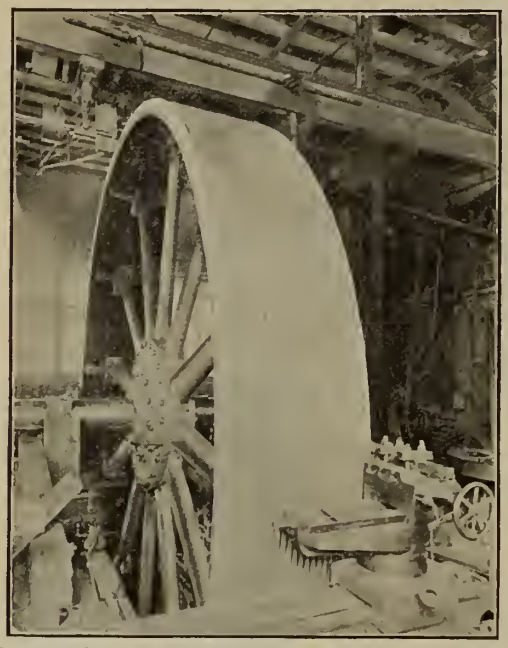
We manufacture Steam Pumps, Power Pumps, Condensers, Travelling Cranes, etc. : : : :



DROP US A LINE, AND WE SHALL BE GLAD TO GIVE ANY PARTICULARS YOU MAY DESIRE

## IRON CASTINGS

ALL SIZES



Rope Pulley ,30 ft. diameter, made at our works for Canada Tin Plate and Sheet Steel Co., Morrisburg.

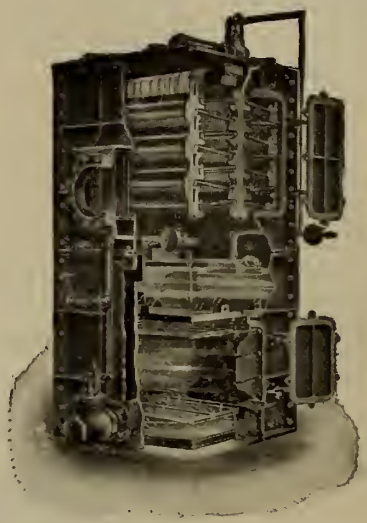
LAURIE ENGINE AND MACHINE CO., Ltd.

MONTREAL

## Steam Power Users

Are you permitting condensations and exhaust steam to go to waste? The

**Webster Feed Water Heater Purifier and Filter**



turns waste into profit by utilizing all condensations and exhaust steam. We have been in this business a great many years and have accumulated a vast fund of experience which is at your service.

The 2,000,000 h.p. of Webster Heaters in use to-day is surely the best of recommendations!

Write for Our Booklet !

DARLING BROTHERS, LIMITED

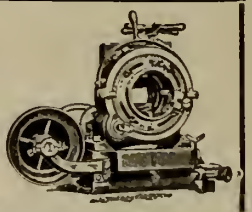
TORONTO MONTREAL WINNIPEG

FRANK DARLING, Agent, Vancouver, B.C.

## HAND OR POWER

Pipe Cutting and Threading Machines. The machine we illustrate comes supplied with fittings for power operation ; power base, pinion, etc. Taken from its base it can be used as a hand machine. Works in small space.

CATALOG ?

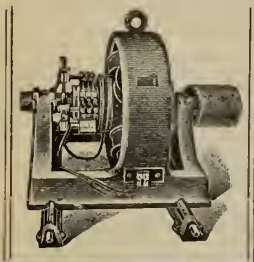


THE CURTIS & CURTIS CO., *36 Garden Street, Bridgeport, Conn., U.S.A.*

OWEN SOUND IRON WORKS, LIMITED

*OWEN SOUND, ONT.*

Cement Mill Machinery, Boiler and Steel Tank Work of all kinds, Grey Iron and Brass Castings



## LIGHTING and POWER PLANTS

*MOTORS FOR DIRECT CONNECTION TO MACHINES*

TORONTO & HAMILTON ELECTRIC CO.

99-103 McNab Street, HAMILTON, ONT.

## Eugene F. Phillips Electrical Works, Limited

Montreal, Canada

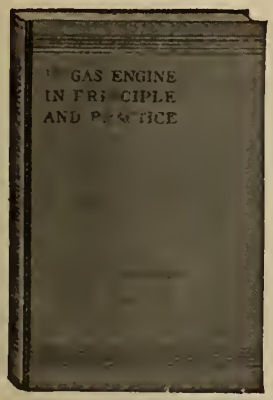
TORONTO STORE, - - 67 ADELAIDE ST. EAST

## Magnet and Trolley Wire
## Bare Copper Wire, Weatherproof Wire

# Books For Engineers

**(All Orders Payable in Advance)**

## The Gas Engine in Principle and Practice




by A. H. Goldingham.

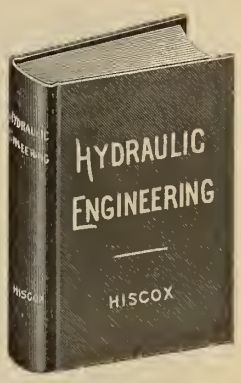
Price $1.50, Postpaid
195 pages, 107 Illustrations

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

## Hydraulic Engineering

By G. D. Hiscox

Price $4.00 Postpaid
320 Pages. 305 Illustrations.




JUST OFF THE PRESS—this comprehensive book of Hydraulics written by an experienced engineer. It is a practical treatise on the properties, power and resources of water for all purposes, including the measurement of streams, the flow of water in pipes or conduits; the horse power of falling water; turbine and impact water wheels; wave motors, etc. All who are interested in Water Works Development should have a copy.

## Power Stations and Transmission

by G. C. Shaad

Price $1.00, Postpaid. 160 Pages, 43 Illustrations

This manual of approved American practice in the construction, equipment and management of electrical generating stations, sub stations, and tranmission lines, for power, lighting, traction, elcetro-chemical and domestic uses, embodies the practical experience of the best authorities and should be in the hands of EVERY ELECTRICAL WORKER.

## The Steam Engine

by W. B. Snow and W. S. Leland.

Price $1.00 Postpaid. 150 Pages, 63 Illustrations

This book is a practical guide for engineers, firemen, machinists and shopmen in general. It gives the details and principles of the operation of steam engines in a way that everyone can grasp. The four sections in the book are devoted to Details of Construction and Types of Engines, Engine-room and Engine Operation, Thermodynamics of the Steam Engine, and the Steam Turbine.

## Practical Gas and Oil Engine Hand Book

by Brooks

Price $1.00 Postpaid. 160 Pages, Illustrated.

This work gives full and clear instructions on all points relating to the care, maintenance and repair of Stationary, Portable, Marine and Automobile Gas and Oil Engines, including "How to Start," "How to Stop," "How to Adjust," "How to Repair," "How to Test an Engine". It furnishes practical information regarding the construction, operation and management of gas, gasoline and kerosene engines.

## New Catechism of Electricity

by N. Hawkins, M.E.

Price $2 00. 550 Pages, 300 Illustrations.

A practical treatise on the care and management of electric plants and apparatus—a book to aid the average man rather than the inventor or experimenter. It contains all the (book) information necessary for an experienced man to take charge of a dynamo or plant of any size. Contents include Dynamo, Electric Lighting, Electric Railway, Telephone and Telegraph, Etc. Bound in red leather, pocket-book form.

# MacLean Publishing Company,

**TECHNICAL BOOK DEPT.**

**10 Front Street East, - - Toronto, Canada**

# ¶ Every Manufacturer and Engineer will find several articles in this issue which might easily be the means of effecting a large saving in their plant.

¶ The mere reading of an article will not do the work, but the wide-awake man will be able to get a suggestion that can be applied to his own plant —either now or in the near future.

¶ This issue is only a sample of what we intend giving every month. Our editors, who are practical men with experience, are promising improvement in each succeeding issue.

¶ Mr. Manufacturer, if you miss reading any one issue of The Power House, you lose.

¶ ONE DOLLAR a year, and you will be kept posted on all the latest and best power and engineering news.

¶ NOW is a good time to send in your subscription.

☞ Use the attached coupon.

CUT OFF HERE AND MAIL NOW

**THE MACLEAN PUBLISHING CO. Limited**
**10 Front St. E.**
**TORONTO**

Please mail to address below one copy of "THE POWER HOUSE" for twelve months. Enclosed find one dollar to pay for same.

*Name* .....

*Street No.* .....

*City or Town* .....

*Province* .....

## The Maclean Publishing Co.

**Limited**

**10 Front Street East,**

**TORONTO**

PUBLISHED MONTHLY

John Bayne MacLean, *President*

ONE DOLLAR PER YEAR

# THE POWER HOUSE

A Monthly Newspaper devoted to the Generation, Transmission and Application of Power

EUROPEAN OFFICE 88 Fleet Street, London, E.C.

MONTREAL 232 McGill Street

TORONTO 10 Front Street East

WINNIPEG 511 Union Bank Bldg.

Toronto, September, 1908.

Dear Sir,-

A short time ago we announced our decision to issue a publication devoted exclusively to power users and men in charge of power plants, and this letter accompanies the first number of "THE POWER HOUSE."

The time has been short in which to do full justice to ourselves as publishers, but we think a creditable issue has been produced. We are not at all satisfied, however, and with more time at our disposal we can promise you that each succeeding issue will show improvement.

Briefly, our aim will be to furnish reliable information on power problems affecting the user of power - the man who pays the bill - both from a business and technical standpoint; and at the same time furnish practical information which will make the paper indispensable to the man in charge of the power plant.

We hope to have the support of every manufacturer and engineer in Canada in our effort to produce a power paper worthy of Canadian institutions.

You can show your appreciation by filling out the blank below and mailing it to us, with the subscription price - $1.00.

Do this TO-DAY. To-morrow will bring new opportunities and duties.

Yours very truly,

THE MACLEAN PUBLISHING CO., Limited.

---

_____ _____ 1908.

The MACLEAN PUBLISHING CO., Limited,
10 Front St. East, Toronto.

Gentlemen, - Enclosed find One Dollar for which mail to address below one copy of "THE POWER HOUSE" for twelve months, and until countermanded.

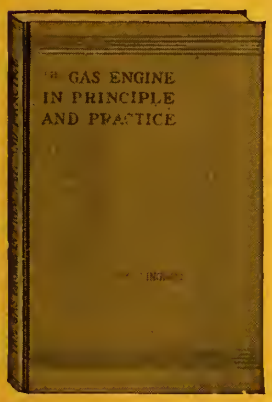
Name, _____

Address, _____

# Books For Engineers

**(All Orders Payable in Advance)**

## The Gas Engine in Principle and Practice

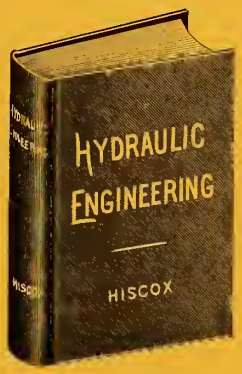



by A. H. Goldingham.

Price $1.50, Postpaid
195 pages, 107 Illustrations

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

## Hydraulic Engineering




By G. D. Hiscox

Price $4.00 Postpaid
320 Pages. 305 Illustrations.

JUST OFF THE PRESS—this comprehensive book of Hydraulics written by an experienced engineer. It is a practical treatise on the properties, power and resources of water for all purposes, including the measurement of streams, the flow of water in pipes or conduits; the horse power of falling water; turbine and impact water wheels; wave motors, etc. All who are interested in Water Works Development should have a copy.

## Power Stations and Transmission

by G. C. Shaad

Price $1.00, Postpaid. 160 Pages, 43 Illustrations

This manual of approved American practice in the construction, equipment and management of electrical generating stations, sub-stations, and tranmission lines, for power, lighting, traction, elcetro-chemical and domestic uses, embodies the practical experience of the best authorities and should be in the hands of EVERY ELECTRICAL WORKER.

## The Steam Engine

by W. B. Snow and W. S. Leland.

Price $1.00 Postpaid. 150 Pages, 63 Illustrations

This book is a practical guide for engineers, firemen, machinists and shopmen in general. It gives the details and principles of the operation of steam engines in a way that everyone can grasp. The four sections in the book are devoted to Details of Construction and Types of Engines, Engine-room and Engine Operation, Thermodynamics of the Steam Engine, and the Steam Turbine.

## Practical Gas and Oil Engine Hand Book

by Brooks

Price $1.00 Postpaid. 160 Pages, Illustrated.

This work gives full and clear instructions on all points relating to the care, maintenance and repair of Stationary, Portable, Marine and Automobile Gas and Oil Engines, including "How to Start," "How to Stop," "How to Adjust," "How to Repair," "How to Test an Engine". It furnishes practical information regarding the construction, operation and management of gas, gasoline and kerosene engines.

## New Catechism of Electricity

by N. Hawkins, M.E.

Price $2 00. 550 Pages, 300 Illustrations.

A practical treatise on the care and management of electric plants and apparatus—a book to aid the average man rather than the inventor or experimenter. It contains all the (book) information necessary for an experienced man to take charge of a dynamo or plant of any size. Contents include Dynamo, Electric Lighting, Electric Railway, Telephone and Telegraph, Etc. Bound in red leather, pocket-book form.

# MacLean Publishing Company,

**TECHNICAL BOOK DEPT.**

**10 Front Street East, - - Toronto, Canada**

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

## ENGINEERS' SPECIALTIES

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

# THE IMPROVED
# J.M.T. INJECTOR

embodies recent improvements in construction, thereby greatly increasing the range of pressure under which injector will successfully operate.

***Works from 18 to 20 lbs. to 220 lbs.***

***IMPROVED J. M. T. INJECTOR***

It works under a wider range of pressure than any other injector. Has improved drain valve to prevent freezing in cold weather. Guaranteed for

***Simplicity*** ***Efficiency*** ***Durability***

Manufactured by

## The JAS. MORRISON BRASS MFG. CO., Limited

***93-97 Adelaide St. West*** ***TORONTO***

PROCURABLE OF YOUR JOBBER CR DEALER

***J.M.T. Valves are used everywhere***

CIRCULATES IN EVERY PROVINCE OF CANADA.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. I. Publication Office, Toronto — November, 1908 No. 3

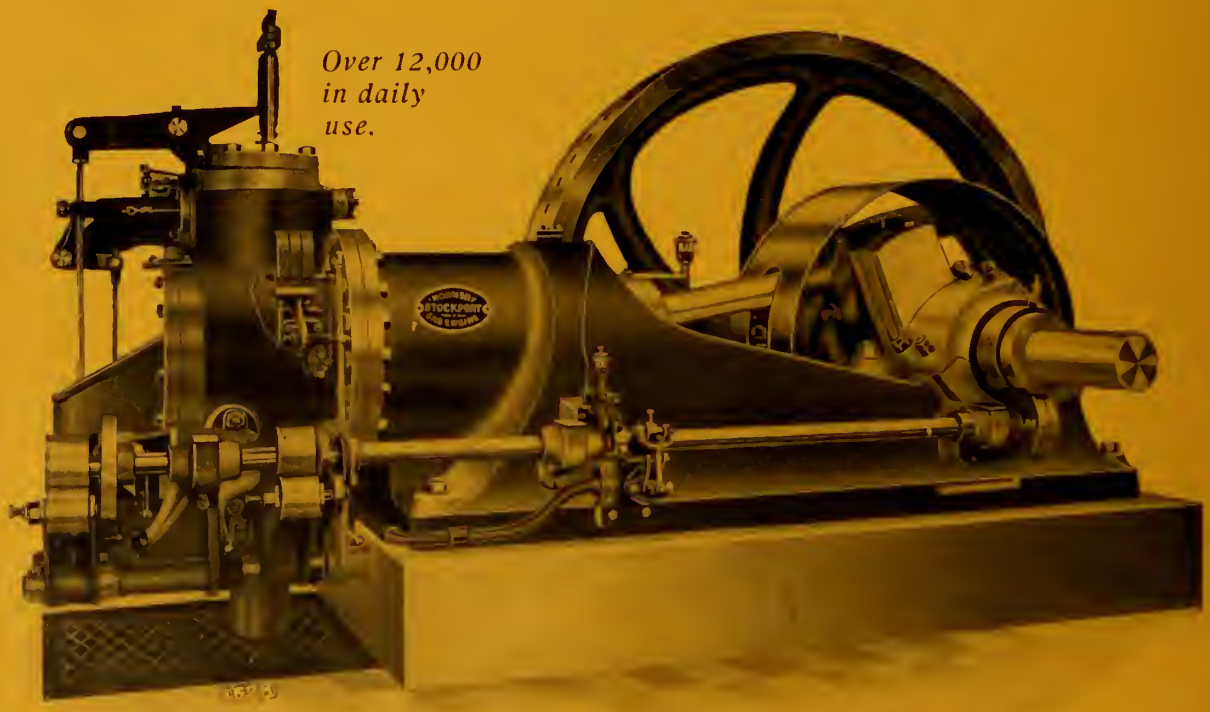
## $12.00 per Annum per Brake Horse Power

# Hornsby-Stockport GAS ENGINES

(BUILT IN ENGLAND)

ECONOMY
EFFICIENCY
SIMPLICITY
RELIABILITY
DURABILITY

*Over 12,000 in daily use.*



Plants have already been installed or Ames-Holden Limited, Shoe Manufacturers, Montreal, 200 h.p. ; Empire Manufacturing Co., London, Ont., 100 h.p. ; Queen City Printing Ink Co., Toronto, Ont., 50 h.p. ; Anchor Fence Co., Stratford, Ont., 40 h.p. ; the City of Chatham, Ont. (municipal lighting plant), 200 h p. ; Dominion Brewery, Toronto, Ont., and a number of other plants are now in progress.

See Report of Expert Tests on page 23.

## Colonial Engineering Co., Limited

CONSULTING AND CONTRACTING ENGINEERS

222-224 St. James St., Montreal

# POWER

## AUTOMATIC McEWEN ENGINES

# BOILERS

## ACCESSORIES

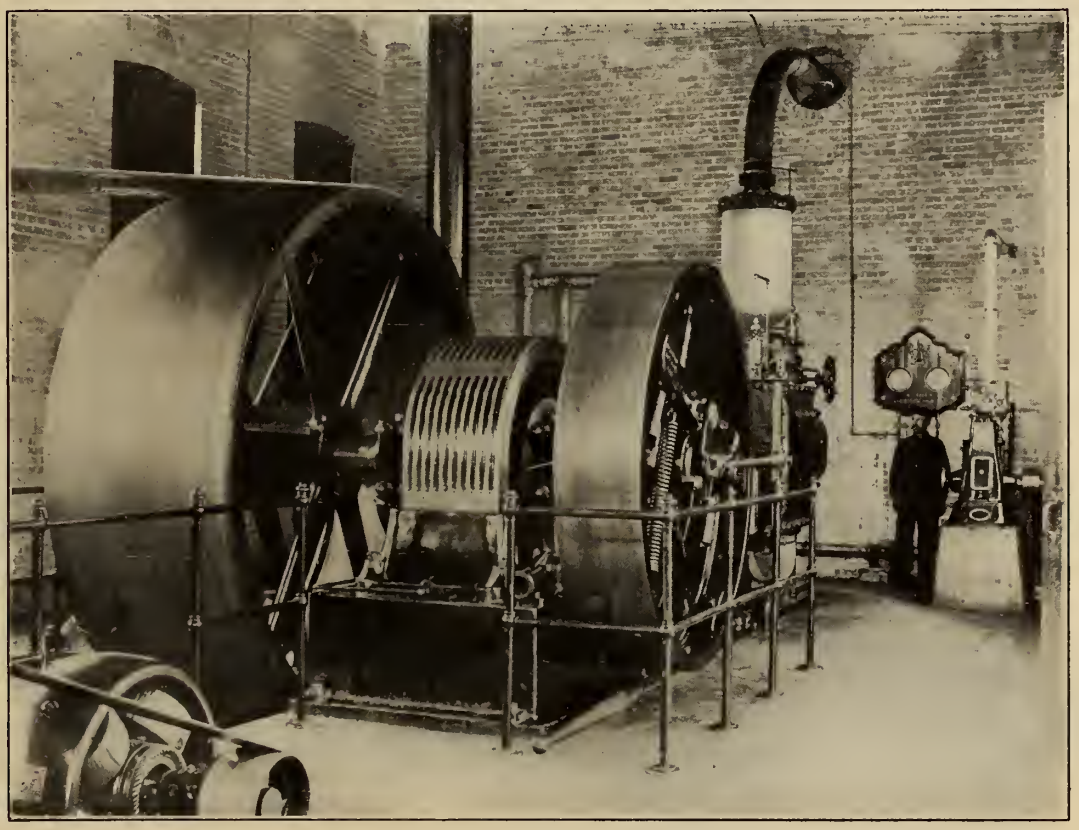


Illustration shows Power House of the Western Counties Electric Co., equipped with belted Horizontal Tandem Compound McEwen Automatic Engine 19 and 32 x 24, developing condensing 600 h.p., we also supplied for this plant three 200 h.p. forced Draft Boilers, Condensers, Heaters, Pumps, Etc.

WE MANUFACTURE FULL LINE OF BOILERS, STATIONARY AND MARINE, STACKS, TANK WORK, ETC., ENGINES—SIMPLE AND COMPOUND, FOR BELTED OR DIRECT CONNECTED ELECTRICAL WORK.

ALSO FULL LINE SAW MILL, PULP MILL MACHINERY AND FIRE APPARATUS.

## The Waterous Engine Works Co., Limited

**BRANTFORD, - ONTARIO**

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

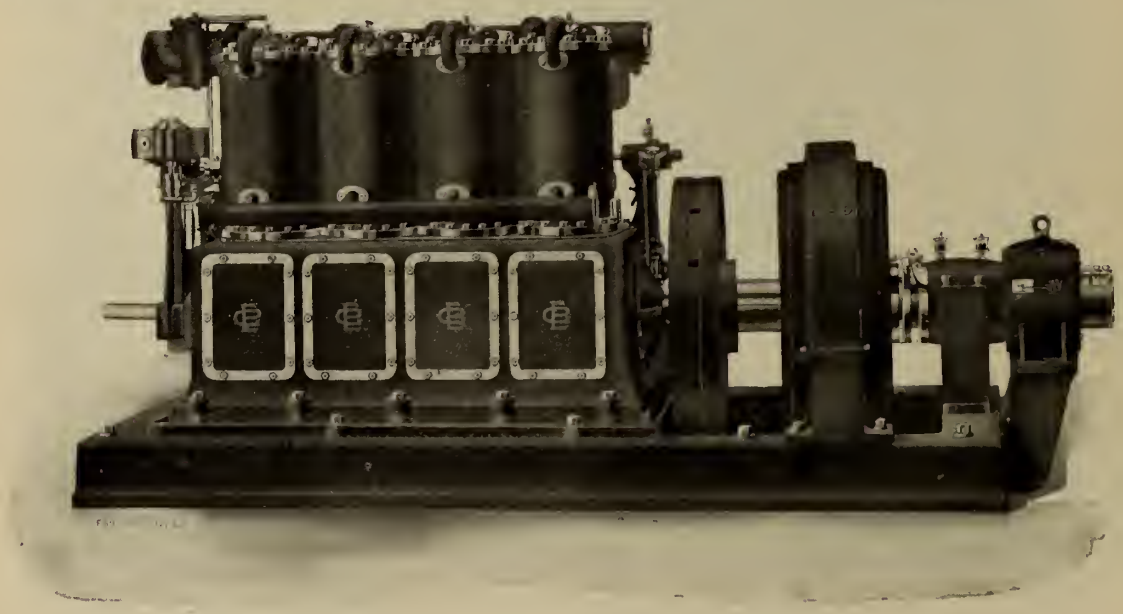
# The Gas and Electric Power Co.

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants
## Pressure Gas Plants

10 to 1,500 B. H. P.

Great Economy in Working.
Extreme Simplicity.
Plant occupying the smallest amount of space.

Little or no Cost in Repairs.
No Gas Holder. No Boiler.
No Chimney. No Smoke. No Soot.
No Smell. No Danger.



Ready for use in 20 minutes. Low Initial Expense.
Saving 50 to 80 per cent. over steam.
Engine direct connected to Alternators.
Guaranteed to run in parallel successfully.

## Complete Plants Equipped and Erected.

PRICES AND PARTICULARS FROM

# The Gas and Electric Power Co.

STAIR BUILDING, BAY STREET
TORONTO

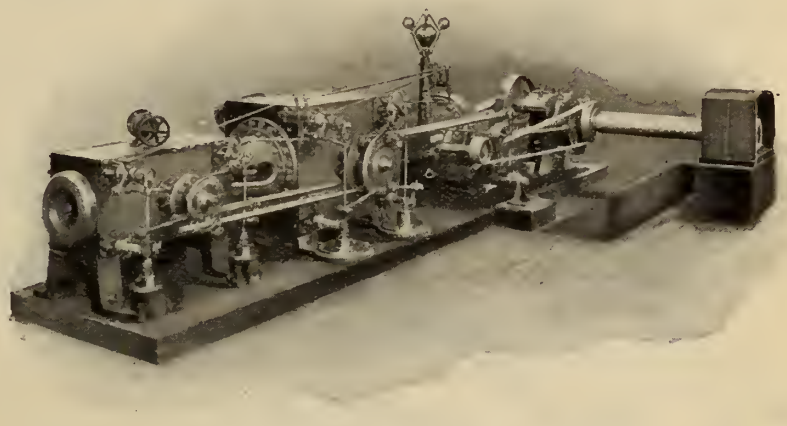
# Jenckes Corliss Engines

Built in all sizes from 75 h.p. upwards.

We make them both simple and cross or tandem compound, condensing or non-condensing, as desired.

Our Corliss Engines have won an enviable reputation for economical and all round, satisfactory running.

Write for bulletins and prices.



TANDEM COMPOUND JENCKES CORLISS ENGINE

## The Jenckes Machine Company, Limited

**GENERAL OFFICES: Sherbrooke, Que.**

**WORKS: Sherbrooke, Que.; St. Catharines, Ont.**

**SALES OFFICES: Sherbrooke St. Catharines Cobalt Rossland Vancouver Halifax**

# POWER

## Nagle Corliss Engines

High Speed Slide
Valve 5 to 300 H.P.

## "Rusten" Suction Gas Plants

8 to 100 H.P.

## Boilers

**Horizontal**
**Vertical**
**Locomotive**

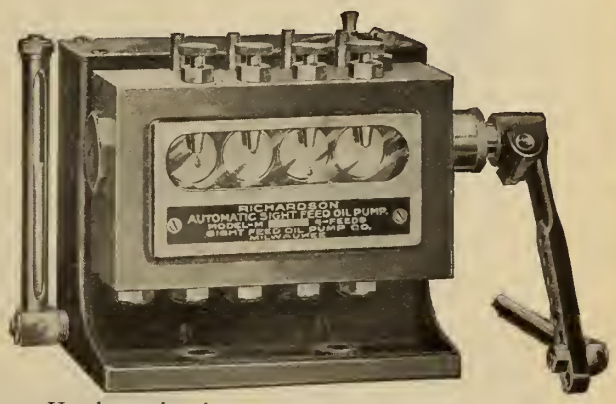
PUMPING MACHINERY & TRANSMISSION SUPPLIES

## Canada Machinery Agency

**W. H. NOLAN, Prop.**

298 St. James Street MONTREAL

# The Model "M" Method




You know that the most economical and perfect lubrication is secured by an automatic oil pump that positively delivers small quantities of oil to the steam at very frequent intervals.

Tool steel polished plungers, hardened check valves, adjustable metallic packing, and other refinements of construction are a part of the interesting details of Model "M."

The Model "M" Method ! Do you know about it ? Told in Bulletin No. 109-L.

**Manufactured by**

## SIGHT FEED OIL PUMP CO.

**Milwaukee, Wis., U.S.A.**

# You Don't Mind Paying a Bill for a Good Belt !

but you hate to get billed for a poor belt. It is annoying ! Don't buy a poor belt. Don't buy any kind of a belt from a firm whose reputation is not of the very highest.

There's a sound reputation behind every inch of

# D. K. McLaren, Limited

## GENUINE OAK TANNED

# Leather Belting

We claim that our belting has more solid leather to the foot than any other belting on the market, that it is all British Oak Tanned — a method well known for many years for its vigorous system of inspection and classification of hides and leather. All hides used in our belting are trimmed before being tanned, when shoulders, necks and bellies, being inferior parts, are cut away.

**Special Conditions call for Special Belts.**

Our long experience and great facilities are always at your disposal for special orders.

Write for PRICE LIST

Write for PRICE LIST

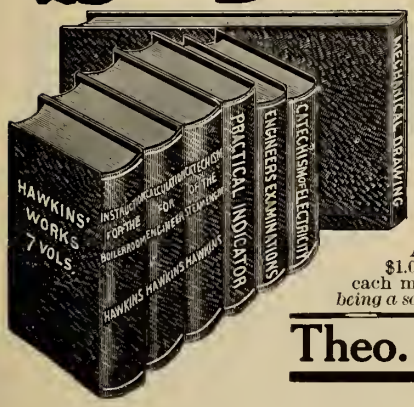
# D. K. McLAREN, LIMITED

| MONTREAL | TORONTO | QUEBEC | ST. JOHN, N.B. |
|---|---|---|---|
| 309-311 Craig Street West | 200 King Street West | 21 St. Peter Street | 64 Prince William Street |

| WINNIPEG | VANCOUVER |
|---|---|
| Fred. J. C. Cox & Co., Representatives | 418 Abbott Street |

**Full stock of our "Extra C" Leather Belting and "D.K." Balata at above addresses.**

*Hawkins Works*




## On Easy Payments.

Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

**SPECIAL OFFER** Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month *(when complete set is purchased the price is $12, being a saving of One Dollar)*. **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE, NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed ..... (Firm Name)

Home Address .....



**Every Manufacturer Using a Steam Boiler Should Know** that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)

IS THE

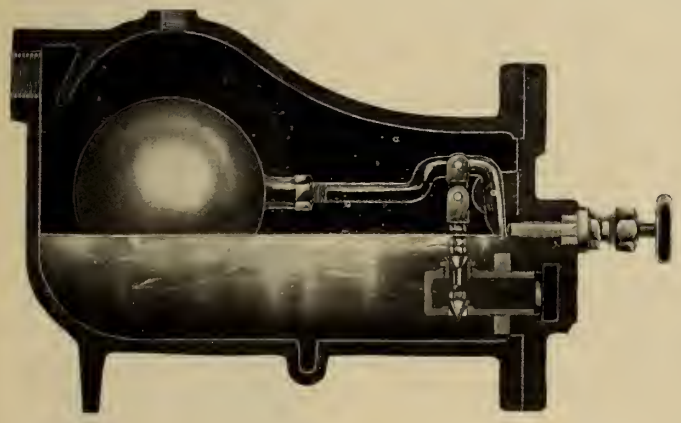
## GUARANTEED BOILER CLEANER

Manufactured by

**The CANADA CHEMICAL MANUFACTURING COMPANY, Limited**

Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL





## The Modern Steam Trap

# Sheldon Continuous Flow Float Trap

**Adapted for High or Low Pressure Work**

Greater capacity than single valve traps.

Discharges continuously as fast as the water enters.

Double cone-shaped balanced valves operated by a high pressure seamless copper float, tested to 300 pounds pressure.

The conical shape of the valves makes it impossible for them to stick or be affected in any way by foreign matter which may enter the trap.

All working parts attached to the trap cover, which can be removed without disturbing the inlet or outlet pipe connections.

By-pass valve in cover so steam can be given a free passage around the valves when desired.

Casing provided with bosses which are tapped for gauge glass and air cock.

Write for Sectional Catalogue No. 56.

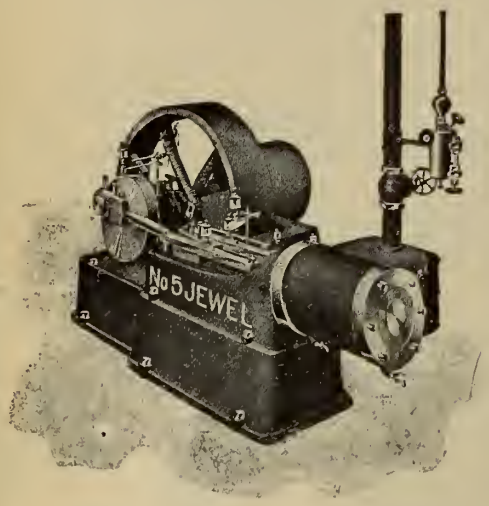
Eastern Agents:
**ROSS & GREIG**
**225 St. James Street**
**Montreal, P.Q.**

# SHELDONS LIMITED

**GALT, ONTARIO, CANADA**

**Stocked in all sizes for immediate shipment.**

# Steam Equipment




## Automatic Engines

1 13" & 23"x30" compound Wheelock
1 refitted 14"x34" R.H. Wheelock.
1 refitted 13"x30" R.H. Corliss.
1 refitted 12"x30" R.H. Corliss.
1 refitted 9½" & 14½"x12" compound.
1 refitted 8" & 13"x18" compound.
1 refitted 12"x10" Westinghouse Junior.
1 nearly new 12"x12" Armington & Sims.
1 refitted 10"x10" Leonard, Peerless.
1 new 10"x15" Jewel No. 8.
1 rebuilt 7"x10" Leonard, Ball.
1 refitted 6½"x9" Armington & Sims.

## Vertical Engines

1 refitted 16"x16" slide valve.
1 new 7½" x10" Dutton slide valve.
3 new 7½"x9" Dutton slide valve.
1 new 7½"x8" Dutton slide valve.
1 refitted 7"x8" Troy slide valve.
2 new 6"x7½" Dutton slide valve.
1 refitted 5½"x7" Doty slide valve.
1 new 5"x7½" Dutton slide valve.
1 new 4½"x5" Dutton slide valve.
1 new 4"x5" Dutton slide valve.
1 refitted 4"x4" Bell slide valve.
1 new 3½"x5" Dutton slide valve.

## Horizontal Engines

1 refitted 16"x24" L.H. rocking valve.
1 refitted 11"x15" C.C. slide valve.
1 new 12"x15" C.C. slide valve.
1 refitted 12"x12" C.C. slide valve.
1 refitted 10½"x14" C.C. slide valve.
1 refitted 10½"x16" R.H. slide valve.
1 new 10"x15" C.C. slide valve.
1 refitted 11"x11" C.C. rocking valve.
1 refitted 9"x14" R.H. slide valve.
1 new 9"x12" L.H. slide valve.
1 refitted 9"x12" L.H. slide valve.
1 rebuilt 8¾"x12" L.H. slide valve.
1 refitted 8¾"x9" R.H. slide valve.
1 refitted 8"x13" R.H. slide valve.
1 refitted 8"x12" R.H. rocking valve.
1 nearly new 7"x10" C.C. slide valve.
1 refitted 7"x11" R.H. slide valve.
1 refitted 6½"x10" L.H. slide valve.
1 new 6"x9" C.C. slide valve.
1 refitted 6"x10" R.H. slide valve.
1 nearly new 6"x7½" C.C. slide valve.
1 refitted 6"x6" C.C. slide valve.
1 refitted 5"x6" R.H. slide valve.
1 refitted 5"x6" C.C. slide valve.
1 refitted 4"x5" C.C. slide valve.
1 refitted 2½"x3" C.C. slide valve.

## Fire-box Boilers

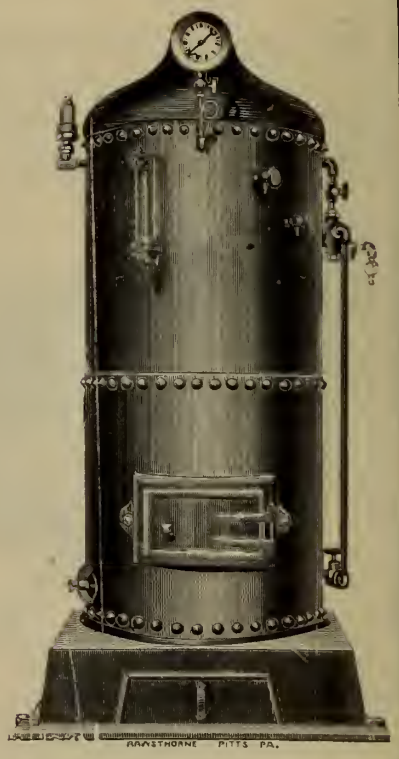
1 refitted 60"x16' with 70—3" tubes.
1 refitted 48"x20' with 52—3" tubes.
1 nearly new 44"x18' with 48—3" tubes.
1 new 39"x14'8" with 36—3" tubes.
1 refitted 36"x13' with 44—2½" tubes.
1 refitted 36"x12' with 43—2½" tubes.

## Vertical Boilers

1 refitted 48"x10'6" with 152—2" tubes.
1 new 40"x64" with 140—1¼" tubes.
1 new 36"x96" with 55—2" tubes.
2 new 36"x84" with 55—2" tubes.
3 new 36"x72" with 55—2" tubes.
3 new 30"x72" with 43—2" tubes.
1 new 30"x60" with 43—2" tubes.
1 refitted 30"x65" with 44—2" tubes.
5 new 26"x60" with 37—2" tubes.
1 new 24"x60" with 31—2" tubes.
1 new 24"x60" with 31—2" submerged tubes.
1 refitted 26"x48" with 37—2" tubes.
1 refitted 24"x48" with 19—2½" tubes.
1 refitted 24"x36" with 61—1½" tubes.
1 refitted 20"x49" with 19—2" tubes.
3 new 20"x43" with 19—2" tubes.
1 refitted 22"x50" with 22—2" tubes.
1 new 20"x36" with 16—2" tubes.
2 refitted 20"x36" with 16—2" tubes.
19 new 19"x44" with 13—2" tubes.
5 refitted 19"x44" with 13—2" tubes.
1 refitted 12"x24" with 19—1¼" tubes.

## Horizontal Boilers

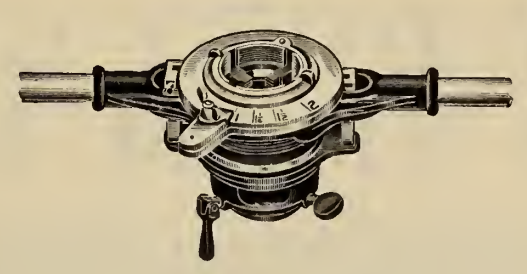
1 refitted 66"x14'7" with 106—3" tubes.
1 refitted 60"x17'6" with 54—4" tubes.
1 refitted 63"x14' with 64—3½ tubes.
1 refitted 60"x14'7" with 74—3" tubes.
1 refitted 56"x14'4" with 64—3" tubes.
1 nearly new 60"x12' with 82—3" tubes.
1 refitted 54"x14' with 70—3" tubes.
1 refitted 60"x13'6" with 72—3" tubes.
1 refitted 50"x14' with 64—3" tubes.
1 refitted 54"x12' with 64—3" tubes.
1 refitted 56"x12' with 60—3" tubes.
1 refitted 52"x11' with 68—3" tubes.
1 refitted 48"x13'6" with 44—3" tubes.
1 refitted 50"x13'11" with 50—3" tubes.
1 refitted 48"x15'6" with 52—3" tubes.
1 refitted 48"x13'6" with 42—3" tubes.
1 new 44"x10' with 38—3" tubes.
1 refitted 44"x11'6" with 43—3" tubes.
1 refitted 44"x11'9" with 42—3" tubes.
1 refitted 44"x11'3" with 36—3" tubes.
1 refitted 44"x10' with 48—3" tubes.
1 refitted 40"x13'4" with 36—3" tubes.
1 refitted 36"x11'6" with 32—3" tubes.
1 refitted 38"x15' with 34—3" tubes.
1 refitted 38"x13' with 33—3 tubes.
1 refitted 38"x12' with 26—3" tubes.
1 refitted 36"x11'9" with 23—3" tubes.
1 refitted 38"x10' with 28—3" tubes.
1 refitted 32"x11' with 23—3" tubes.
1 refitted 30"x8' with 16—3" tubes.
1 refitted 43"x49" with 60—2½" tubes.



***A Copy of our Supply Catalogue or Monthly Stock List for the asking***

# H. W. Petrie, Limited

**Toronto** **Montreal** **Vancouver**



# The "Beaver" Die Stock

*Threads four sizes of pipe without changing dies*

¶ Just figure out what a lot of time you can save with a "Beaver" when you have any pipe-threading to do.

¶ Instead of hunting out a different die stock for each size of pipe, you can adjust your "Beaver" to any of the four sizes within its range in a "jiffy."

¶ The threads cut by a Beaver are always absolutely accurate and properly tapered.

¶ No danger of stripping threads when you are using a "Beaver" because the cutting dies are automatically released when backing off.

**Number 6 "Beaver" cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by a single cam, so constructed as to move one set of dies back while the other set is in use.**
**Number 2 "Beaver" cuts 1-in., 1¼ in., 1¾-in., 2-in. pipe. One boy can successfully operate this tool.**
**Number 4 "Beaver" cuts 2½-in., 3-in., 3½-in., 4-in. pipe and takes a man to operate.**

## You Need a "Beaver" in Your Business

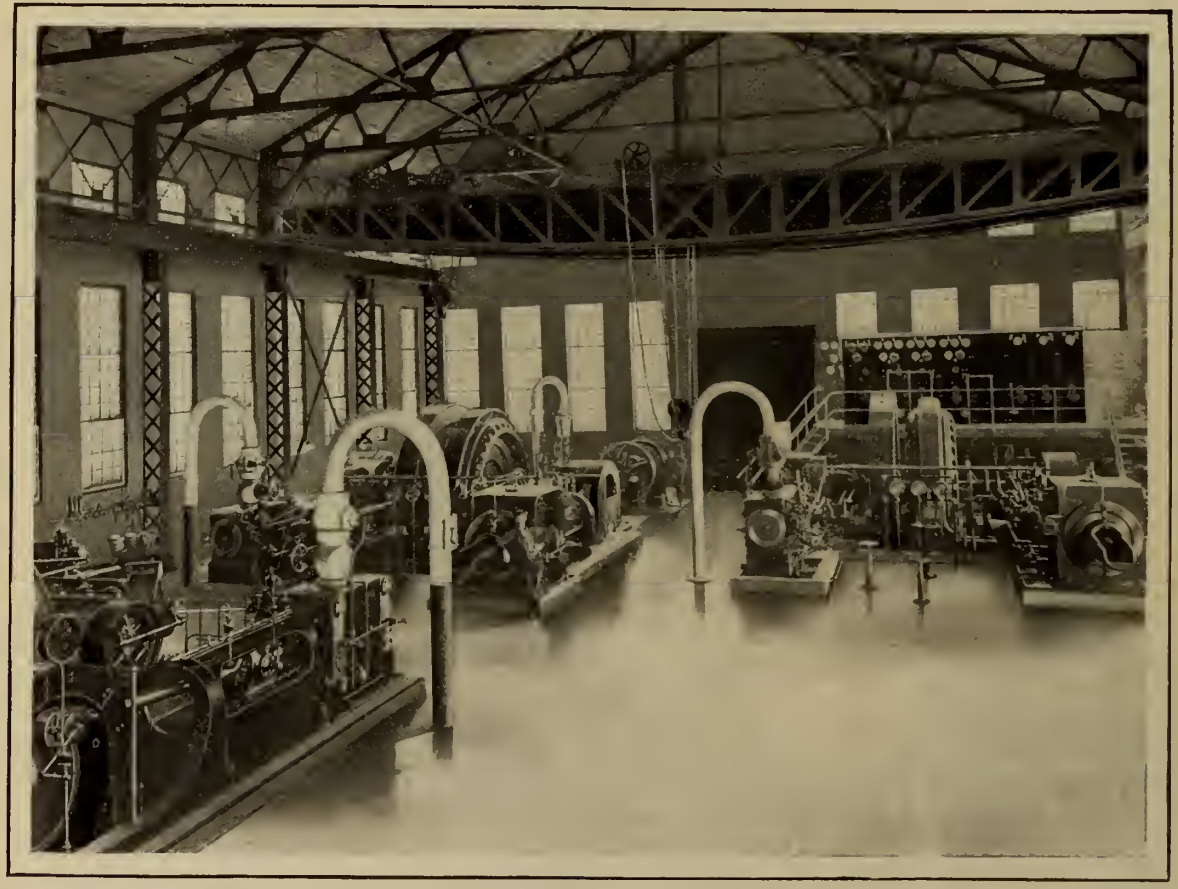
LET US SEND ONE TO YOU ON TEN DAYS' TRIAL.

If you say it isn't as satisfactory as we claim, we'll take it back without it costing you a single cent.

## Borden-Canadian Company

**66 Richmond Street East——————Toronto, Ont.**

# HEAVY DUTY GOLDIE CORLISS STEAM ENGINES



POWER HOUSE OF THE DOMINION COAL CO., GLACE BAY N. S.

*EQUIPPED WITH :—*

THREE PAIR OF CROSS COMPOUND, HEAVY DUTY, GOLDIE CORLISS ENGINES, each 20 and 40 x 36, and Two 12 x 12 IDEAL HIGH SPEED ENGINES

*EVERYTHING THAT IS BEST IN POWER EQUIPMENT*

## The Goldie & McCulloch Co., Limited

### GALT, ONTARIO, CANADA

WESTERN BRANCH,
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS,
Ross & Greig, Montreal, Que.

B. C. SELLING AGENTS,
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Boilers Special Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION

# Huronian Company's Power Development at High Falls*

## General Layout of Power Scheme, Dams, etc., with Description of Power Plant, Transmission Lines and Various Sub-Stations and Equipments.

By R. A. ROSS and H. HOLGATE.

The Canadian Copper Co. operates numerous nickel and copper mines in what is known as the Sudbury District, the principal mines being at Copper Cliff, Creighton and Cream Hill. The smelter at which these ores are treated is located at Copper Cliff. To develop and transmit power for their requirements and for other purposes the Huronian Company was incorporated.

The cost of coal for operating the smelting plant and machinery at the mines induced the Huronian Company to acquire the property known as High Falls, on the Spanish river, in the Township of Hyman, and in the spring of 1904 work was begun upon the development of this water power.

High Falls lies abour four miles north of the "Soo Branch" of the Canadian Pacific Railway, at a point about 28 1-3 miles west of Sudbury. A line of railway was built from the C.P.R. to the site of the works, and all necessary buildings were erected for housing the workmen and storing material. This preliminary work was ready about September 1st, when work on the actual development was commenced.

Above High Falls, for a distance of six miles, the Spanish river is a succession of rapids, and it was considered necessary that these should be drowned so as to prevent the formation of frazil, and to form as much of a reservoir as possible. For these reasons the river level above the falls was raised 18 feet, drowning all troublesome rapids, pro-

Fig. 1—General Site, High Falls.

Fig, 2—Power Station, High Falls.

Fig. 3—Dam and Forebay.

Fig. 4—Dam on West Side of River.

* From a paper read before Canadian Society of Civil Engineers, April, 1907. The equipment added since then has been included, bringing the description up-to-date.

viding a storage basin about six miles long, and increasing the head from 67 to 85 feet.

The system of dams necessary to control the water was somewhat complicated, and work on three of them was carried on continuously to completion, notwithstanding the severe winter of 1904-5. At the same time the concrete foundations of the power house were built to above high-water so as to avoid any delay in the following spring. A log-slide and two temporary openings were left in two of the above dams so as to pass water when it became necessary to stop the water on the east side of the river. The channel on the east side was then closed up by a crib cofferdam against a head of 32 feet of water. This cofferdam was built in the form of the letter "V" in plan, each leg abutting on the rock projecting outwards and up stream at an angle and finishing square, leaving a key-shape space between the two legs.

The water for the power plant was taken across the island, and to do this it was necessary to construct another series of dams, connecting with the bulk-head, and to close the west channel by dam, shown in Fig. 5, after which the temporary openings in dams first built were closed and the forebay allowed to fill. All of the structures, including the power house, are built on rock, and the forebay of elevation 170 is cut through rock. Sluices arranged in two dams at level 159, which, with the aid of the logslide and penstock, allow (if ever it should be necessary), the water to be lowered to below 170 and render the racks and bulkhead accessible for repairs. These sluices are also intended to be used to relieve the overflow at high water, and are accessible by bridges from the shore ends of the dam, shown in Fig. 3.

As the river is used for lumbering purposes, and as large numbers of logs come down every year, the provision for their passage was made in one of the

Fig. 5—No. 3 Dam, with Sluice and Forebay.

Fig. 6—Log Chute in Foreground.

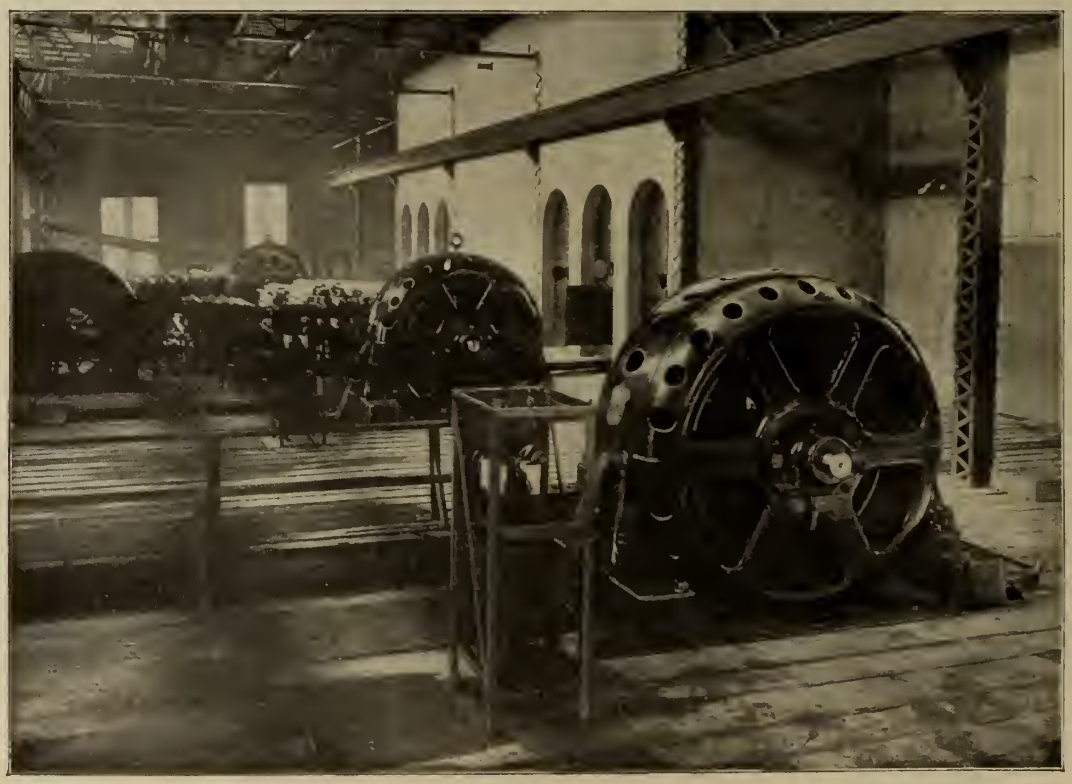


Fig. 7—Three 600 h.p. Induction Motors Driving Blowing Engines.

dams, a system of booms being anchored above to guide the logs to the slide, which carries them to the west channel. In order to insure water in the west channel, the crest of western dam No. 3 was made 18 inches higher than the eastern dam, so that a continual flow is assured in the west channel for logging purposes.

### Dam Construction.

All of the dams are founded on solid rock, ample key trenches being cut in the rock for anchorages, both in the foundation and end walls. The foundation rock was made absolutely clean, not a particle of dust or dirt was allowed to remain, the bottom was then dusted over with neat cement, and over this a layer of mortar 1 to 3 was laid to a minimum depth of 4 inches, when regular concreting was begun. The concrete mixture was all 1 cement, 3 sand and 5 of broken stone, well mixed, and deposited in a very wet mixture. Larger stones were freely used, some measuring over two cubic yards, none being allowed nearer the face of the work than 9 inches, nor nearer each other than 12 inches.

### Bulkhead Wall.

This was constructed generally in the same manner as the other dams, the steel structure for racks and the cones for penstocks being built in the work, all steel work being carefully bedded in and covered with wet mortar. The gates are of steel of split pattern, and are operated by a direct current motor driven from the exciters, or by hand, as required. The exciter inlet is separate from the power wheel inlets, so as to permit of a smaller screen spacing being used in the racks. This necessity at the inlet, and the advisability of having the exciters placed in the middle of the power house floor, required the bending of the exciter penstock from the end of the bulkhead wall to a position in the centre of the power house as the drawings indicate. The bulkhead was housed, so as to protect the operators in severe winter weather.

The entrance cones, built in the concrete wall, are 10 feet in diameter at the upper end, and 9 feet in diameter at the outside of the wall; the penstocks are 9 feet in diameter from this point to the wheel cases, and are of steel plate, resting on concrete saddles, spaced at two diameters of the penstock centres. The penstocks are four in number and are anchored in the centre of their length, an expansion joint being provided near the bulkhead wall and also one near the power house in each.

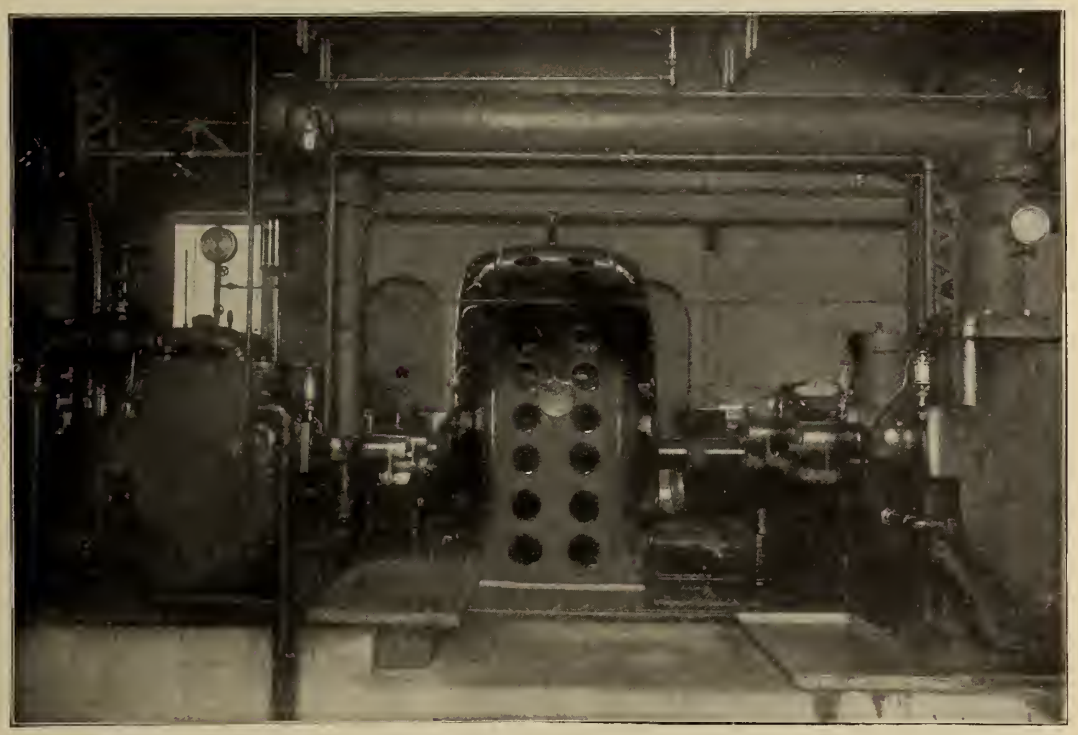


Fig. 8—One 300 h.p. Induction Motor Direct Connected to Compound Air Compressor.

### Power House.

The foundations of the buildings are carried down to rock, at a depth of about 30 feet below the floor level.

The floor arrangement of the power house provides for two exciters in the middle of the room, each capable of serving four generators, both being furnished with water from one penstock, and each provided with an hydraulically operated gate valve. The power units are arranged with two on each side of the exciters. In the centre of the building is the switch tower, and on each side of it are the transformer compartments separated from the main room by steel doors. A railway track leads into the power house, and an overhead crane commands all the machinery, the transformers being all mounted on trucks, which can be pushed forward so as to bring them under the crane.

The roof of the transformer rooms and of the switch tower is of concrete, and the roof of the main building is of pine 2x4 inches, laid on edge on steel trusses, and covered with 26-gauge galvanized iron. The building is heated from a boiler placed in a room on the east end of the building, the Sturtevant system of warm air being used. A room is also provided for stores and small repair work, furnished with a complete lavatory. The tail race was excavated to ample size, and some necessary retaining walls and cribs were built for its protection.

The walls of the power house were built of red brick, laid in a mortar consisting of Portland cement and lime.

### The Turbines.

The main turbine wheels were designed for a maximum of 3,550 h.p. each. Each turbine operated a 2,000 k.w. generator, so that the wheels have a capacity sufficient for operating the generators at 33 per cent. overload. The effective head is 85 feet, and the speed is 375 r.p.m. The wheels are enclosed in steel cases,

with case and head split horizontally so as to give quick access to the moving parts in case of repairs being necessary. One pair of wheels is used in each unit, the diamater being 34 inches, the runner being of bronze. The thrust bearing is of the marine type, located between the wheel case and the generator. The case head bearing is in effect merely a stuffing box and really takes no weight. The gates are of bronze of wicket design, being as nearly as possible balanced, and are operated by a governor of the Sturgess type. The exciter turbines are similar in design, and are also controlled by Sturgess governors ; all governors are electrically controlled, being handled from the controlling desk by the operator on duty, who can start up any or all machines from this point. The total full load capacity of the station is 8,000 k.w. Tachometers are attached to each main unit.

### Generators and Exciters.

The electrical plant was designed for the eventual instalation of four generators, two of which are at present operating, and a third has been contracted for. These generators are each 2,000 k. w. capacity at 80 per cent. power factor, 3-phase, 25 cycles, operating at 2,400 volts. The revolving field is mounted on a steel shaft with the coupling forged out of the solid and directly connected to the water wheels.

The exciters, two in number, are of 200 k.w. capacity each, operated at 550 r.p.m., each being of a capacity sufficient to furnish excitation for the four generators. These exciters are also directly connected to their own wheels.

### Switchboard.

The switchboard for the main station, supplied with its equipment by the Canadian Westinghouse, Hamilton, consists of seven panels of blue Vermont marble, upon which are mounted the necessary electrical appliances, and is arranged for the control and operation of the following apparatus :

Three 2,000 k.w. 2,200 volt 25 cycle, 3 phase a.c. generators ; two 200 k.w. 125 volt exciters ; nine 667 k.w., 2,200 to 33,000 volt raising transformers, and two 3 phase high tension transmission lines. The layout, however, provides for the future addition of one generator and another bank of transformers.

The electrical control of the generating, transforming and high tension apparatus is accomplished from the switchboard gallery, so located that the machines are under the eye of the operating electrician. Instead of the usual vertical panels, the switchboard takes the shape of a bench-board or control desk, which extends across the gallery. Near the outer edge of the gallery are placed the instrument pedestals, each generator having its individual pedestal containing the necessary indicating meters. A pedestal at the centre, which is pivoted so that same can be turned at any convenient angle to face the operator, contains the meters for the transformers and high-tension lines. Mounted in a convenient position on the wall is a large synchroscope with a 36-inch dial, having a revolving illuminated pointer. A signalling device is also installed, by means of which orders are given by the switchboard operator to the operator at the turbines.

The control desk consists of seven sections in all ; there being four for the generators, two for the exciters and one for the transformers and high-tension lines. The various metal parts on these panels have a black oxide finish to prevent discoloration, which might be caused by the sulphurous fumes from the smelters. Immediately behind the switchboard gallery is a tower 18 feet by 21 feet by about 50 feet high. This section is of fireproof concrete construction throughout and contains the busbars and circuit-breakers, together with the necessary disconnecting switches and connections for both the low-tension and high-tension circuits, the low-tension apparatus being on the lower floor and the high-tension apparatus on the floor above.

The circuit-breakers are all of the Westinghouse Standard separate cell type and are electrically operated by means of the controlling switches on the switchboard. In case of over-load or other trouble these breakers are auto-

Fig. 9—One 500 h.p. Induction Motor Driving Blowing Engine.

matically opened by the action of relays. There are two sets of 2,200-volt bus-bars and two circuit-breakers for each generator, so that the generator may be connected to either set of bus-bars. These circuit breakers are electrically interlocked so as to prevent both being closed at the same time. There are also two circuits-breakers for each bank of transformers, while on the 33,000 volt side, the bus-bars are in two sections, with a tie-breaker between. This arrangement makes possible effective interworking, either for operating convenience or emergencies.

The protective apparatus for the two high-tension lines is situated near the point where the wires leave the tower.

The sub-station equipment consists of fourteen panels, upon which are located the apparatus for the control of :

Three 667 k.w. 33,000 to 2,200 volt lowering transformers ; three 175 k.w. 2,000 to 550 volt transformers ; twelve 2,200 volt feeders.

The general arrangement of above is much the same as in the power house ; the switchboard, however, is of the usual panel type and provision is made for extending same when necessary.

In order that power may be always available for operating the circuit-breakers, a set of storage batteries is installed, together with other necessary apparatus.

Besides the equipment already mentioned, the Canadian Westinghouse also installed three 275 k.w. transformers, 3,000 alts, 34,000 volt, primary to 575 volts secondary ; three 175 k.w. transformers, 3,000 alts, 34,000 volt, primary to 575 volts secondary.

The entire switchboard instalation has been carefully designed throughout, both as regards accessibility of apparatus and convenience of operation, and every reasonable precaution has been taken to eliminate all elements of danger, and everything conforms to the high standard of Westinghouse practice.

For fire protection of the wooden penstock covering, bulkhead structure, and other buildings, a 500-gallon 2-stage turbine pump, directly connected to a 50 h.p. direct current motor and supplied with current from the exciter circuit, has been located between units Nos. 1 and 2, (Fig. 8) with water connection to both penstocks, so as to ensure at all times a supply of water to the pump. From the pump a dry pipe line has been run with outlets at various points along the penstock, and a line has also been carried over to protect the houses of the employes.

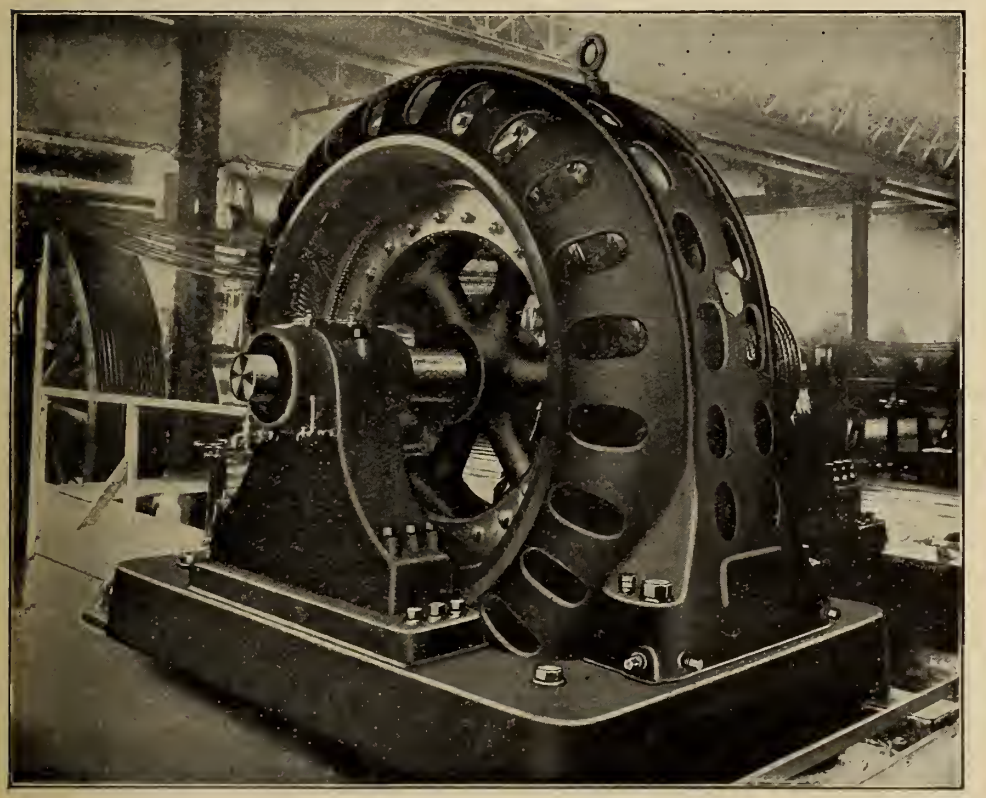


Fig. 10—500 h.p. Induction Motor Driving a Blowing Engine.

### Transmission Line.

The transmission line from High Falls to Copper Cliff, operating at 35,000 volts, is about 29 miles long, and runs for the most part upon a right of way acquired immediately outside that of the Soo Branch of the Canadian Pacific Railway, thus affording ready access from the railway at all points. The line consists of two 3-phase circuits of No. 1 wire, one line being transposed three times, and the other running straight through.

The telephone line was placed on the Canadian Pacific Railway Company's telegraph poles on the opposite side of the track, at a distance of about 80 feet, to avoid the possibility of induction.

There is a double pole construction throughout. Owing to the wires being spread far apart, it would be impossible to carry the two circuits on one pole, so that in the interest of structural stability it was advisable, instead of instaling a second pole line, to combine the two with a common cross arm ; these cross arms being made of long leaf Southern pine. This gives a very solid structure, and eliminates a lot of guying and strutting.

The insulators were tested for a period of 15 minutes at a voltage of 70,000, and the result of this very rigid test, especially as regards time, was that the lines were energized without a single breakdown.

The high tension exits of the lines from the power station and entrances to the sub-stations have been made through 18-inch tiles with plate glass screens, and have given no trouble, except at the sub-station at Copper Cliff, where sulphur fumes and metallic dust from the smelter have deposited from time to time, forming a scum, over which leakage has taken place. This has been remedied.

Aerial switches for isolating the branches to Cream Hill and Creighton Mines have been located at Victoria Mine and Quartz Quarry.

---

### COPPER CLIFF SUB-STATION.

The apparatus in the different sub-stations forms an interesting application of electricity to mining and smelting operations. The induction motors aggregating over 5,000 h.p. were built by Allis-Chalmers-Bullock, Limited, of Montreal.

The main sub-station is at Copper Cliff, and contains, in addition to electrical apparatus, some very interesting machinery for the operation of the smelter, etc., as follows :

Six 667 k.w. transformers, 33,000 to 2,200 volts ; three 175 k.w. transformers, 2,000 to 500 volts ; one 40 k.w. motor generator set, 575 a.c. to 250 d. c., for operating furnace charging locomotives ; one 75 k.w. frequency changer set, 25 to 60 cycles, for operating the a.c. series arc circuits used for lighting the streets ; thirteen feeder and control panels for transformers, motors, lighting, etc.; one storage battery for operating distant control switches ; seventy-five light capacity in constant current a.c. are regulators.

Three 600 h.p. Allis-Chalmers-Bullock, Montreal, induction motors each connect-

ed to a blowing engine having a capacity of 35,000 cubic feet of air at 40 oz. pressure. These blowing engines are driven by the motor with 18 1½-inch Manilla ropes on the English system, shown in Fig. 7.

The motors are fitted with a special speed-changing controller, arranged for controlling speed by changing the number of poles in stator, with electric locking device to prevent the operation of controller when motor is in operation. These motors are mounted on base rails, and are fitted with the regular starting compensators and circuit-breakers.

One 300 h.p. A.-C.-B. induction motor, Fig. 8, directly connected to a compound air compressor operating at 100 lbs. pressure and 120 revolutions per minute. The speed of this motor is constant, the compressor being fitted with an unloading device, which is automatically brought into use when the pressure rises or falls below 100 lbs. This motor is fitted with starting compensator and circuit-breaker.

One 500 h.p. A.-C.-B. induction motor, Fig. 9, constant speed, operating at 375 revolutions per minute, connected to a blowing engine having a capacity of 10,400 cubic feet of air at 12 lbs. pressure, and driven by 16 1½-in. manilla ropes on the English system. This motor is mounted on sliding base rails, and is equipped with the regular starting compensator and circuit-breakers. Space is provided for a second blowing engine of the same capacity as above engine.

### Use of Turbine Pump.

This sub-station also contains the following Worthington turbine pumps built by the John McDougall Caledonian Iron Works Co., Limited, of Montreal :

One 4-stage, 6-inch, Worthington turbine pump directly connected to a 225 h.p. A.-C.-B. induction motor ; this outfit being used for fire protection, is connected to a dry fire line, which is piped around yards and buildings. The supply of water to this pump is taken from a 16-in. water main under 20 lbs. pressure, being obtained from a series of small lakes by gravity.

One 2-in. vertical Worthington turbine pump and direct connected A.-C.-B. motor, with automatic starting switch, operated by a float, is used to pump the water from the sump, which is located in the basement. The transformer cooling water drains into this sump, as well as any scapage.

Two 8-in. single-stage Worthington turbine pumps directly connected to 80 h.p. A.-C.-B. induction motors, housed in a separate pump house, which is used to circulate the water supply to the furnace jackets.

One 5-in., 2-stage Worthington turbine pump directly connected to a 50 h.p. A.-C.-B. induction motor is located near the smelter furnace gallery, which pump is held in reserve in case of the molten metal burning its way through between the furnace jackets. This pump is used to supply water to chill same and stop the flow of metal.

One 10 h.p. A.-C.-B. induction motor belted to a Sturtevant blower and located in sub-station, is used in connection with the hot blast heating system of the sub-station.

This sub-station is constructed entirely of concrete, with a steel frame and book tile roof, and covers approximately one-half acre of ground.

### Cranes.

Besides two 10-ton cranes, two 40-ton alternating cranes with five 60 h.p. A.-C.-B. induction motors have been installed in the smelter for the handling of ladles carrying melted matte. These alternating current motors operate under the most adverse conditions, in an atmosphere of tremendous heat and covered with sulphur fumes and metallic dust from the furnaces and converters. The converters also are tipped by alternating current motors from a controlling stand some distance away.

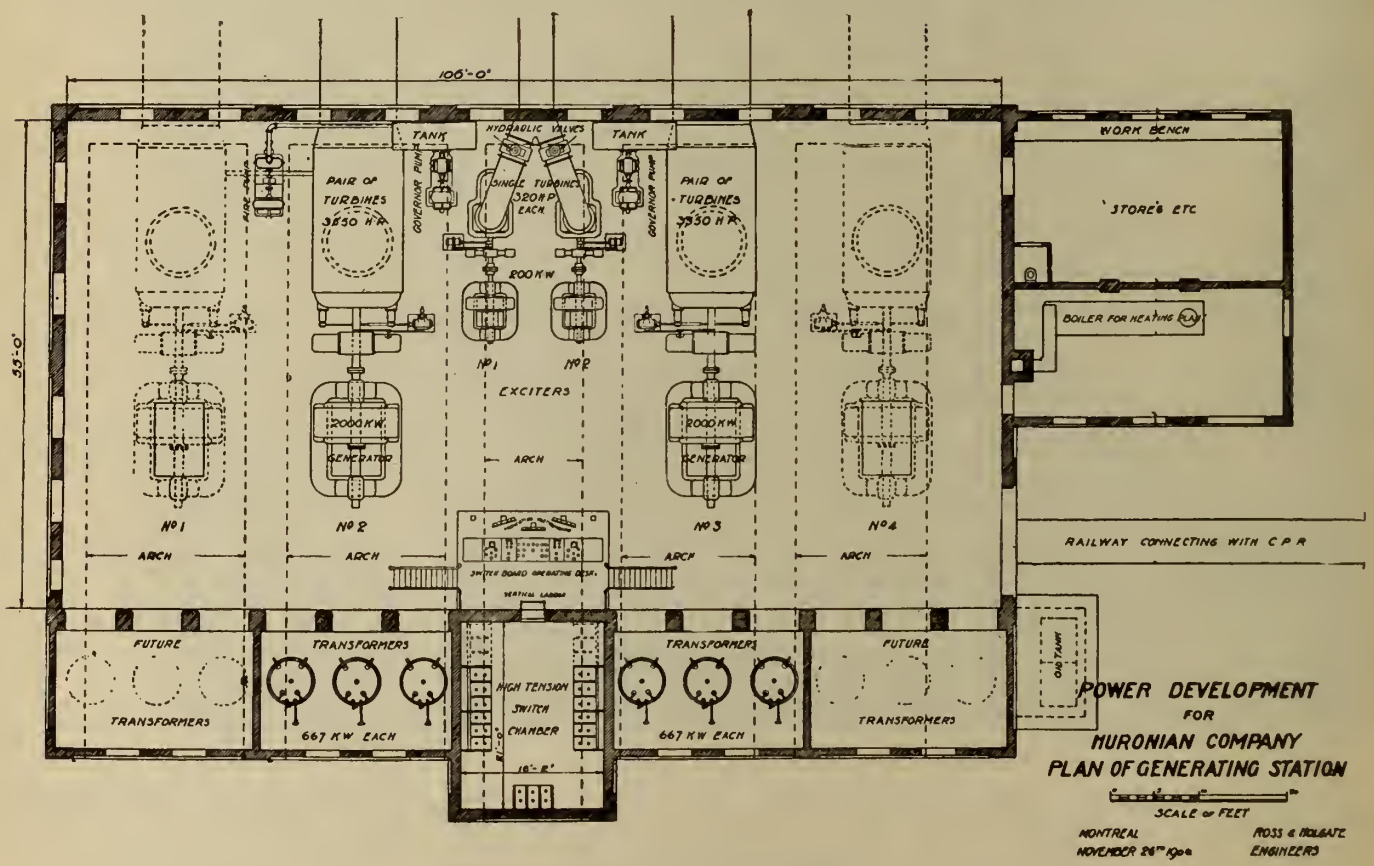



Fig. 11—Plan of Generating Station.

## CREAM HILL SUB-STATION.

This sub-station is connected to the first branch taken off one of the two

main transmission lines, which is approximately 3½ miles long and of sin- switches located at point of departure from the main line. The sub-station building is constructed of concrete and brick and provided with a 10-ton hand-power traveling crane.

For the housing of lightning arresters, high-tension line switch, choke coils, disconnecting switches, etc., a tower has been provided in one corner of the building.

For the reception of the 3 175 k.w. 35,000 to 550 volt, oil-filled, water-cooled transformers, a special fireproof compartment has been provided with iron doors, so as to completely isolate the transformers from the main building, this being practically the same scheme as followed at the main power house at High Falls.

For the control and distribution of power to the various receivers throughout the mines, the necessary totalling and feeder panels have been provided, the cables to and from same being run in fibre conduit and laid in the concrete floor.

### Air Supply.

For supply of air to the mines, a compound, direct-driven air compressor has been supplied, operating at 120 r.p.m. and supplying 1,635 cubic feet of free air per minute, with an intercooler of extra large capacity. As the speed is constant, regulation is obtained by automatic Corliss valve step regulation.

For driving the compressor, a 300 h.p. A.-C.-B. induction motor, 3-phase, 550 volt induction motor has been installed, with the motor mounted on the main shaft of the compressor, operating at 120 r.p.m. and provided with all the necessary starting compensator, circuit-breakers and panel. Two more similar motors were mounted later.

### Mine Hoist.

In connection with the operation of the mine skips a special three-drum mine hoist has been installed, the drums of which are arranged for the operation of two drums in counter-balance, also independently, or all three together if necessary. The rope speed is 500 feet per minute, and the capacity of each skip 6,000 lbs.

For the operation of this hoist, a 150 h.p. A.-C.-B. 3-phase, variable-speed induction motor has been provided, complete with reversing controller, resistances, circuit-breaker, panel. etc.

### Fire Protection.

For the protection of the buildings and plant, a 1,000-gallon 6-inch, four-stage, Worthington fire pump directly connected to a 150 h.p. A.-C.-B. 3-phase, 550 volt induction motor has been installed ; also a dry fire line has been piped to various points throughout the plant.

### Cooling Water and Water Supply.

The water for cooling the compressor and transformers is kept in circulation by the aid of a 250-gallon, 3-inch, single-stage Worthington turbine pump directly connected to a 5 h.p. A.-C.-B. 3-phase, 550 volt induction motor, operating at 1,500 r.p.m.

For storage of water for the fire pump supply, a street tank holding 60,000 gallons has been erected close to the sub-station, the water for this tank being obtained from a lake 3,000 feet away, at which point a 250-gallon, 4-in., two-stage Worthington turbine pump, with a 20 h.p. A.-C.-B., 3-phase, 550 volt induction motor directly connected to same, and operating at 1,500 r.p.m., is located. For the reception of this outfit a concrete and brick building has been erected.

### Rock House Equipment.

After the skips have delivered their loads, hoisted from the mine to the grizzly, the ore falls by gravity on the spalling floor, and from there is fed into crushers, which are 30x18 inches. After passing through the crushers, the crushed ore passes through special revolving screens, the perforated plates of which are constructed of manganese steel. After passing through the screens the ore falls on the picking belts, each of which is 36 inches wide and approximately 50 feet between pulley centres. The power to operate each crusher, with its complement of screens and picking belts, is obtained from a 50 h.p. A.-C.-B. 3-phase, 550 volt induction motor of the wound rotor type, operating at 500 r.p.m. by means of belting and shafting.

For clearing the mines of water there have been provided special single-acting, vertical, triplex, brass-fitted pumps, each having a capacity of 100 gallons per minute against a head of 250 feet, each pump being connected by gearing to a 15 h,p., A.-C.-B. 3-phase, 550 volt induction motor, operating at 750 r. p.m.

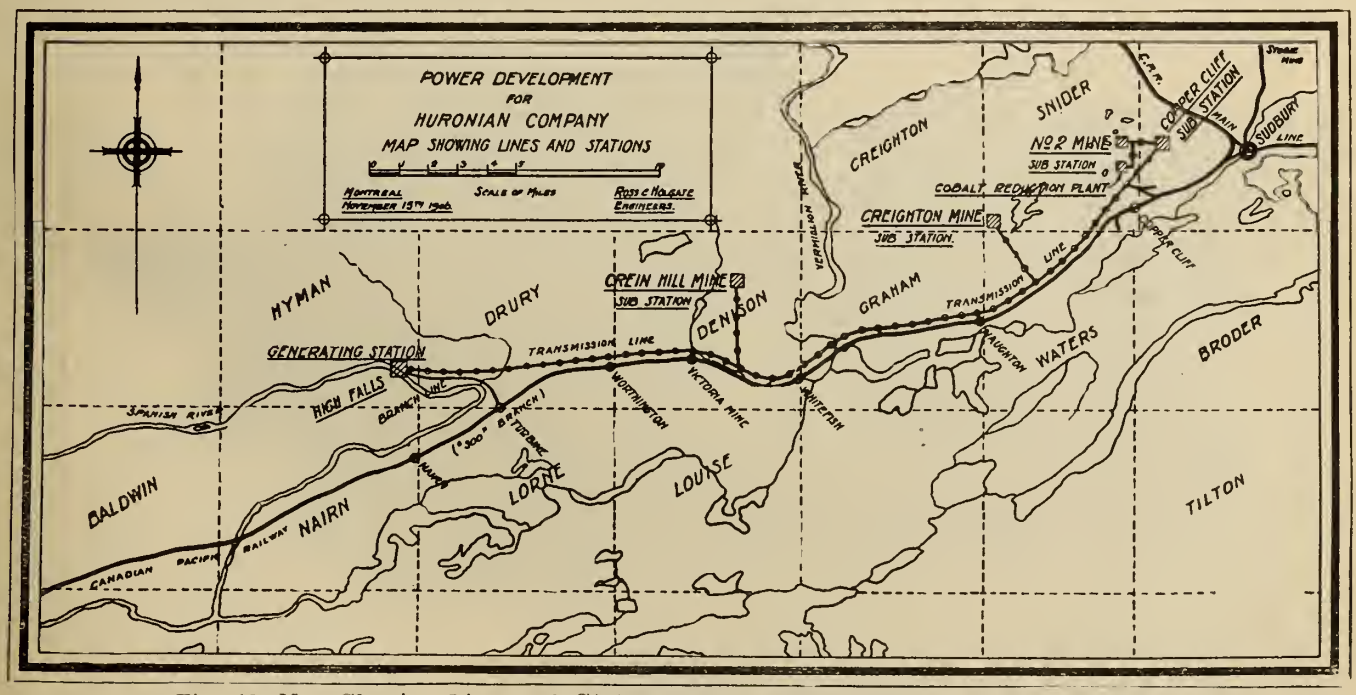



Fig. 12—Map Showing Lines and Stations of Huronian Company's Power Development

## CREIGHTON MINE SUB-STATION.

The sub-station at Creighton Mine is almost exactly similar to that at Crean Hill, and is connected to the second branch line from one of the two main transmission lines, this branch line be-

ing about 3½ miles in length. It is of single pole construction, and has special aerial switches located at the point of departure from the main line.

The building itself, the switching and lightning arrester tower, the transformer compartment, and the switchboard arrangements are almost exactly like the corresponding items at Cream Hill, except that the three transformers have a capacity of 275 k.w. each, instead of 175 k.w.

The apparatus for supplying air to the mines is the exact counterpart of the Cream Hill compressor outfit. There are two mine hoists at Creighton for handling the ore, instead of one as at the former mine.

The devices for fire protection, transformer, and compressor cooling water, and the tank and apparatus for water storage for the fire pump supply are is through totalling and feeder panels. Three 125 k.w. transformers, oil-filled, natural-cooled, reducing from 2,300 to 550 volts, are located in a special fireproof compartment.

The air compressor apparatus is the same as those at Cream Hill and Creighton, except that the driving motor is wound for 2,300 volts.

There is installed for operating the mine skips a special double-drum hoist, arranged for the drums to operate in counterbalance or independently, and, as in the other cases, the rope speed is 500 feet per minute, and the capacity of each skip is 6,000 lbs., a similar motor to the other hoist motors being provided for its operation.

The fire protection apparatus duplicates that installed at the other two mine sub-stations, the supply of water for the pump being obtained by tapping filled, natural-cooled transformers, receiving current at 2,300 volts, 3-phase, 25-cycles direct from the main sub-station and reduced to 550 volts and distributed through control and feeder panels.

In this building is also located a 1,000-gallon, 6-in., 4-stage Worthington turbine fire pump directly connected to a 150 h.p., A.-C.-B., 3-phase, 550 volt induction motor, with control panel, also a dry fire line has been piped to various points throughout the plant. The supply of water to this pump is obtained under 20 lbs. pressure from the domestic service pipes fed from the storage reservoir.

Throughout the smelter the following 3-phase, 550 volt induction motors are installed : three 50 h.p. A.-C.-B. running at 500 r.p.m., and one 35 h.p. A.-C.-B. running at 750 r.p.m. The plant

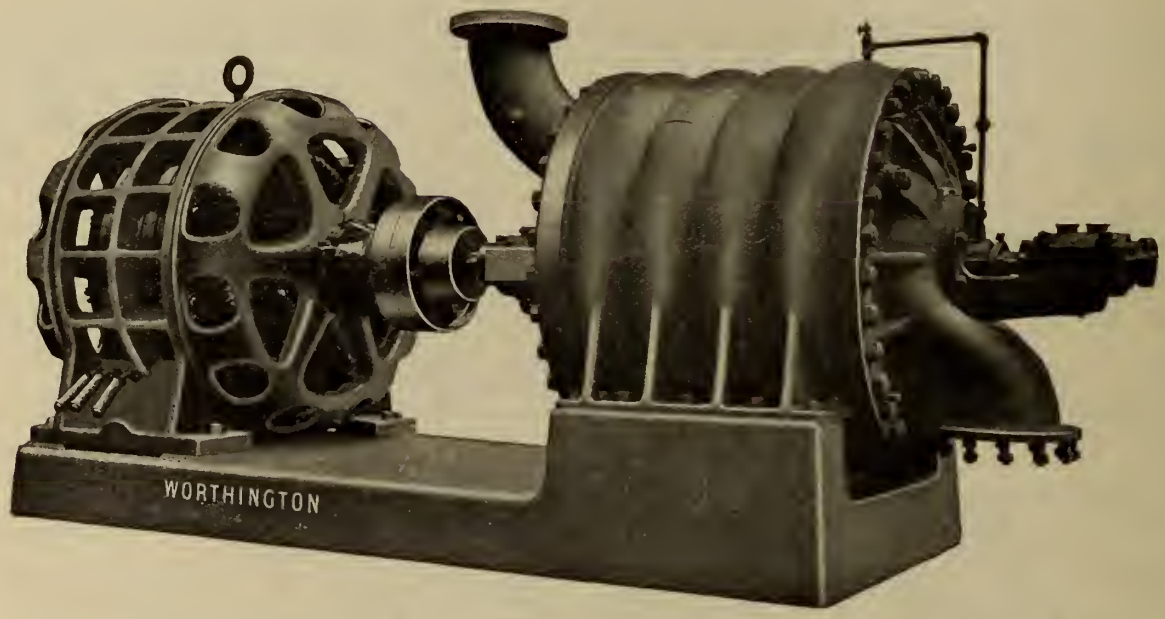



Fig. 13—300 h.p. Induction Motor Direct Connected to 8-inch 4-stage Turbine Pump Built of Bronze to Resist Corrosion.

also the same as the corresponding apparatus at Cream Hill, and the rock house equipment and the mine pumps will, when completely installed, also carry out the general idea of duplication.

—

### NO. 2 MINE SUB-STATION.

No. 2 mine, situated in Copper Cliff, has its sub-station situated approximately one mile distant from the main sub-station. The building, as in the other cases, is constructed of concrete and brick, and has a similar ten-ton crane to handle its apparatus. The supply of current for all purposes is obtained directly from the main sub-station at 2,300 volts, 3-phase, 25-cycles. Part of the machinery in this building is operated at the above pressure, and part at 550 volts, the control of which a 16-inch main, which supplies water to the smelter, while the water for cooling the compressor is circulated by a similar centrifugal pump to those at Cream Hill and Creighton. This applies also to the mine pumps.

For the operation of the machinery in the rock house building, a 50 h.p. A.-C.-B. 3-phase, 550 volt induction motor of the wound rotor type has been installed, all connections to crusher, etc., being by belting.

—

### THE COBALT SMELTER SUB-STATION.

This sub-station is located in Copper Cliff, and is approximately 2 miles distant from the main sub-station. The building is constructed of concrete and brick, and contains three 75 k.w. oil-

was put into operation in February, 1906.

Among the additions since this paper was written are the following motors by the Allis-Chalmers-Bullock, Montreal : Two 500 h.p. induction motors with grooved pulleys for driving blowing engines ; one 225 h.p. for blower ; one 200 h.p. for blowing engine, and one 150 h.p. for turbine pump.

Fig. 10 shows a 500 h.p. motor driving blowing engine. Fig. 11 is a plan of the generating station, showing layout of the plant. Fig. 12 is a map showing the generating station, transmission lines and sub-stations. Fig. 13 is a 4-stage Worthington pump built of bronze to resist corrosion, to which is connected a 300 h.p. motor. This pump has a capacity of 1,200 Imperial gallons per minute against 500 feet head.

# The Municipal Ozone Purification Plant at Lindsay

## First Municipal Ozonizing Plant to Treat Entire Water Supply of a Town on the American Continent—Constructed Under Contract with Lindsay, Ont., by J. Howard Bridge, the Inventor and Patentee.

This new plant, erected in connection with the pumping station, is completed and in running order. The total cost of the plant with a capacity of 1,500,000 gallons, including pre-filter, is $7,250. The cost of operation is 8 h.p., for which the town pays $35 per h.p. per year. This equals $280 for the treatment of 547,000,000 gallons yearly, or 51 cents per million. The plant is being operated by the regular employees of the pumping station.

Besides breaking all waterworks records for cost of instalation and economical operation, Mr. Bridge broke all records for rapidity of construction, which in the purification of a public water supply is of almost equal importance. Mayor Begg, of Lindsay, turned the first sod on August 24th. The plant, including a pre-filter of reinforced concrete, was completed and in operation on October 23rd—a little over eight weeks.

The ozone-purification plant is located at the city pumping station, on the banks of the Scugog River, from which the town supply is taken. The Scugog is a sluggish stream running from a shallow lake of the same name into Sturgeon Lake. The water is strongly charged with vegetable matter derived from the lake and surrounding swamps, and this, besides affording a rich pabulum for bacteria, imparts an unpleasant odor and taste to the water. As a result the citizens have had recourse to well-water, which in itself has not always been above suspicion, and typhoid fever has been quite prevalent in the town.

Prior to the instalation of the ozone plant a rough and ready sort of filtration was practiced, which did little more than strain out the grosser particles of suspended matter. The new system includes a modern rapid filter of reinforced concrete, a sterilizing well forty feet deep and about six feet square, and a purified water basin from which it is pumped directly into the mains of the town. The system is so contrived that the water passes entirely by gravity from the river through the filter and sterilizing well to the suction pipes of the pumps; while in the electrical part of the plant there is a similar absence of mechanical means, so that with the exception of a small blower of ½ h.p., used only when the river is low, there is not a wheel turning anywhere. By an ingenious automatic device the graded opening of a single valve admits varying quantities of water to the apparatus as required by the needs of the town. At ordinary times the pumpage is five hundred gallons a minute. During fires this may be doubled; in either case the rate of filtration and ozone sterilization is simply regulated by the operation of a raw-water valve, and no other attention is required. So, too, when the pumps are completely stopped, provision is made by which the ozone produced is automatically drawn from the ozonizers, so that these may safely run continuously should the attendant neglect to turn off the electric current supplying them.

Aspirator—Sterilizing.

### Details of Plant.

A twelve-inch pipe leads from a crib sunk in the river to a raw-water basin holding fifteen to twenty thousand gallons. From this the water passes into a rectangular tank of reinforced concrete, some 12 feet by 15 feet, where it passes through three feet of coarse sand to strain out the suspended matter. This sand is brought from Birmingham, N.J., 31 tons being required for the Lindsay plant. The pre-filter is cleaned by simply reversing the current, the wash water coming from the city main under a pressure of 60 to 100 lbs. to the square inch. The cleansing process occupies about three minutes, and is practiced every day when the river is especially foul. At other times the filter may run several days without washing. The waste water after washing the sand escapes into the river through two eight-inch pipes furnished with check valves. After rough filtration the water under treatment flows through an eight-inch pipe into another chamber, in which its height is automatically regulated by a butterfly-valve and float. Here it passes into an air-tight box built of concrete, which is directly connected, by means of a two-inch pipe, with the ozonizers, in a small building adjoining. The water now falls down a number of four-inch pipes leading to the bottom of a well, thirty feet deep, and in doing so passes the ends of a great many small brass tubes, through which, by suction, the ozonized air is drawn and thoroughly mixed with the water. An arrangement of baffle-plates prevents the too rapid escape of the ozonized air from the water, and the two fluids, thoroughly co-mingled, flow slowly up the well

into a pure-water basin, where the now-exhausted ozone separates from the water. When thus freed from the purifying gas the water is allowed to pass to the suction pipes of the pumps, which send it at once through the city mains and to the stand-pipe.

The ozonizers occupy a brick building only 8 feet by 10 feet, built against the pump-house. They consist of two iron boxes, each containing twenty-six separate units. Each unit has its own fuse, so that, if by any chance, a short-circuit should occur, the unit affected would be the only one to go quietly out of commission, while the remainder would continue operative. These units are so constructed that a workman can remove or replace them in a few moments.

The city current is brought into the building at 1,010 volts, and is raised by

Sterilizer is in Larger Circular Well, Pre-filter in Rectangular One. Ozonizers Are in Small 8x10 Building at Back of Pump House.

step-up transformers to 10,000 volts. Each of the two ozonizers has its own transformer, and independent air inlet and outlet, so that they may be operated together or separately. The air is sucked into the apparatus by the movement of the water through the sterilizing well, and no air-pump is used, as is the European custom. Nor, contrary to European usage, is anything done to free from moisture the air admitted to the ozonizer. Mr. Bridge has found that while a larger output of ozone results from drying the air admitted to the ozonizer, the difference is not enough to justify the cost of operating a refrigerating machine, or even of instaling any of the chemical dryers used elsewhere. It is by the cutting out of an air-pump, which costs twice as much to operate as does the ozonizer, and the elimination of an air-dryer, that the Howard Bridge system has demonstrated its superiority to that tested by the officials of New York City, who showed that the cost of ozone in water purification is only 25 per cent. of the whole, the remaining 75 per cent. being used up by the air-pump and refrigerating machine.

In regard to the efficiency of the Lindsay plant, it is believed to have met the chief conditions called for in the contract made with the town—that the plant "will successfully purify to an absolutely safe extent, from a sanitary and public health standpoint, the water to be supplied through the said waterworks system, and will remove all objectionable color, taste and smell from the said water, and will destroy all germs or constituents which shall prove dangerous or shall be liable to prove harmful to the health of the people using the same, and shall be bright and clear and palatable to the taste, and shall not be rendered in any way injurious to the waterworks system, or the piping thereof by reason of passing through the said process." The effluent of the plant is clear, bright and palatable, and it is free from objectionable color, taste and smell. Presumably it is also free from noxious germs, as the bactericidal properties of ozone have been so abundantly demonstrated as now to be accepted as a matter of course. An elaborate series of bacterial tests are about to be conducted at the Lindsay plant by Dr. Amyot, official bacteriologist of the Province of Ontario, which will be made public in due time. In the meantime the eyes of sanitarians and hygienists throughout the United States and Canada are directed to this first municipal ozone purification plant on the American continent, which, if it fulfils its present promise, may revolutionize all accepted ideas of the purification of public water-supplies and its costs.

The filtration plant was installed by J. G. Sharpley, M.E., Philadelphia. In Fig. 1 is shown the two ozonizers with their transformers. The cover has been removed from the one on the left and the construction may be seen. The electrified plates are filled with holes,

Two Ozonizers—One With Glass Removed.

not perforated, but such as would be made with a punch. These plates are separated by mica, the air is drawn in and must pass through the holes in these plates. The ozonized air passes through pipes at the back and passes through the water as mentioned above.

Fig. 2 shows the ozone tubes before being placed in position. In the background may be seen the small addition that was necessary to add to the pumping station for the housing of the ozone generators.

---

Look out for the man with a get-rich-quick scheme. A ton of coal will make just so much steam, and it won't make any more by burning it all at once.

# Some Methods of Lubrication that Reduce Insurance Risk*

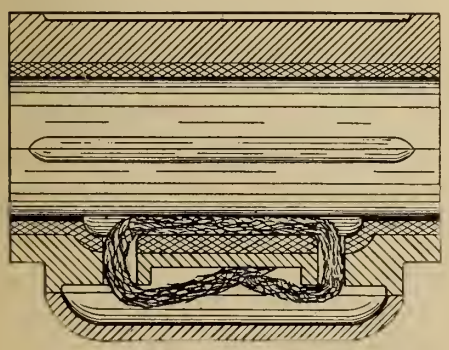
## Requirements of a Good Lubricant—Different Oils are Required for Various Conditions — Classes of Bearings — Causes of Friction Fires.

By PAUL VON SZELISKI.

A hazard common to all factories using power is that caused by excessive friction and poor lubrication. From the following it will be apparent that special care in this direction is necessary in a wood-working risk.

On every surface there exist microscopic irregularities which offer a resistance to the passage of one surface over another. A lubricant introduced between the two surfaces tends to fill the irregular spaces and causes the surface to approach more to being perfectly smooth, and thus to offer less frictional resistance to a body passing over it. A good and safe lubricant should therefore lessen the hazard of friction. The principal lubricants we have to deal with are oils and greases. Oil, to be a good and safe lubricant, should fulfill the following conditions:

1. Diminish friction.
2. Not lose its lubricating property on exposure to the atmosphere (i.e., should not gum).
3. Have no deleterious action on bearings or metallic surfaces.
4. Should have sufficient body (viscosity), so that it is neither squeezed out from between the moving surfaces nor wasted by the motion of the machinery.



Wick Oil Bearing.

5. Should not give off combustible gases or vapors at the temperature to which it is heated when in use.

**Various Oils for Differing Conditions.**

The kind of oils to be used will depend on the varying temperature, speeds, loads, and other conditions to which the bearings are exposed. There may be said to be three kinds of lubricating oils—mineral, vegetable, and animal oil, and their combinations.

The mineral lubricating oils are the higher boiling portions of crude oil, they do not gum, do not become rancid, and consequently do not develop acids liable to affect metal injuriously. However, if not carefully distilled, they give off inflamable vapors. As the lighter

Oil Cups.

inflamable oils bring a better price to the refiner than the lubricating oils, there does not appear to be any very serious danger of highly inflamable oils being furnished by them as lubricants. Mineral oils lose their viscosity under higher temperature, and to remedy this defect the admixture of fatty oils has been resorted to, the fatty oil raising the viscosity of the mineral oil and also decreasing its inflamability. Such mixtures thus combine in some measure the good qualities of both as lubricants.

Fatty oils, however, are not safe from an insurance standpoint, inasmuch as according to their power to absorb oxygen from the air they are liable to cause spontaneous combustion. In bulk they are comparatively harmless, giving off no vapors, and only ignite if set on fire; but divided into fine particles and exposed to the action of the oxygen of the air, an actual chemical union takes place between the fatty oils and the oxygen, and heat is produced, which, if confined, will finally be raised so high as to cause spontaneous combustion.

According to this avidity to absorb oxygen, or in other words to solidify or dry, fatty oils are more or less dangerous.

We will name a few in the order of the degree of hazard they present:

Boiled and raw linseed, used in paints and varnishes.

Tung oil, a very powerful drying oil used in varnish.

Seal oil, for leather dressing.

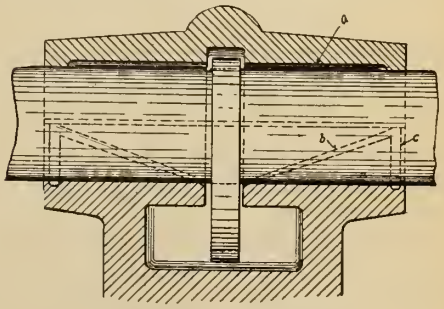
Maize or corn, cottonseed and rape oil, used as adulterants or as admixture of lubricating oils.

Turpentine, used as a powerful solvent for resins and fats in varnish making and in painting. Turpentine is often adulterated by resin spirit and naptha.

The admixture of fatty oils will, as stated, increase the viscosity of mineral oils, but the viscosity of mineral oils can also be regulated by careful distillation and subsequent mixing, thus the viscosity in mineral oils will vary from that of the thin, light-colored spindle oil to that of the dark, thick cylinder oils, and semi-solid greases.

In view of the fact that fatty oils are dearer than mineral oils, there appears to be also no good reason why fatty oils should be mixed with mineral oils.

For use in engine bearings and cylinders, where high temperatures prevail, the admixture of tallow oil is usually resorted to. In marine engines, where there is a risk of water getting mixed with the lubricant, rape and corn oil are mixed with mineral oil, which two



Single Ring Bearing.

oils form a mechanical mixture, usually called emulsion.

Owing to the possible admixture of fatty oils to mineral oils, the only attitude for underwriters to assume is to look with suspicion upon all oils, and insist upon precautionary measures. Waste cans are necessary, as also oil drip cups, unless the bearings are of a modern type, styled oil retaining, or are provided with automatic oiling devices. The more general introduction of improved oil retaining bearings and automatic and adjustable oiling devices

* Abstract from a paper read before the Insurance Institute of Toronto.

shown in illustrations will admit of the use of the lighter mineral oils of less viscosity, as a cheap and safe lubricant, in preference to the dearer and unsafe fatty or mixed oils.

The hazard sometimes existing with empties originally containing volatile liquids such as benzine, gasoline, coal-oil, varnish, turpentine, etc., is seldom realized. In barrels and empties, especially if not completely emptied and exposed to heat, vapors will develop and accumulate, and violent explosions are known to have occurred in consequence of open lights having been brought near them.

This hazard is now receiving attention from factory inspectors.

It might be in place to interpolate here a few remarks about bearings for the benefit of any uninitiated students.

### Classes of Bearings.

A bearing is a support in which a shaft revolves. Sometimes the shaft is rigid and the bearing revolves, and sometimes both may be movable as in the case of the connecting rod and crank or cross head pins of an engine.

We principally meet with the "journal" bearings in which the pressure on the bearing is perpendicular to the axis of the shafting.

In pivot bearings the pressure on the bearing is parallel to the axis of the shaft.

Step bearings is another name for pivot bearings.

The collar bearing has the advantage that it will not gradually wear and let the shaft drop down, as is the case with the pivot bearing, because any number of collars may be used on the same shaft, thus increasing the bearing surface and lessening the vertical wear.

The ball-bearing is a contrivance for lessening the frictional resistance by doing away with sliding friction and substituting rolling friction therefor. It may be used in either of the foregoing classes.

The roller-bearing is used for similar purposes to those for which ball-bearings are used, with the difference that the roller-bearings is used for heavier work, as, for instance, in a line shaft.

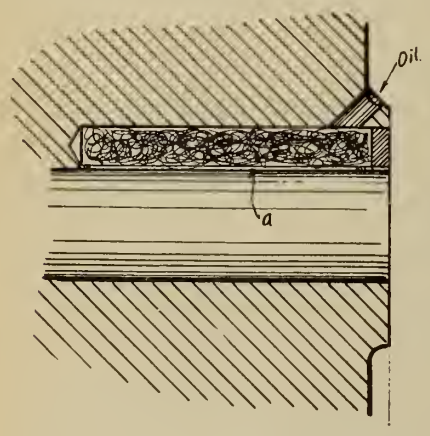
A built up bearing is one made of two or more pieces so arranged that it may be adjusted after it is worn, so that it will fit the shaft.

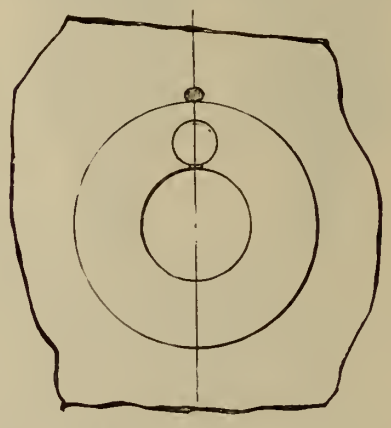
A bearing which is suspended from a beam is called a hanger. A bracket or post hanger supports a shaft along a wall or on a post.

A bearing resting on a support is called a pillow block.

### Babbit Metal.

Cast iron bearings, if well lubricated and kept free from dust and grit, work smoothly under light loads and retain the oil well. But an alloy of tin, antimony, and copper, called babbit metal, mixed in proportions to suit the weight to which the bearing surface will be subjected, is now generally used as a lining for bearings because babbit metal is little liable to heating.



Special Bearing with Reservoir.

### Speed.

Wood-working machines are characterized by their lightness of construction and high speed at which they are operated.

In machine shops, where no inflamable dust should be generally met with, the line shafting is usually arranged to revolve from 80 to 100 revolutions per minute. In a wood-worker, however, where, on the contrary, fine shavings and inflamable dust are present, the main shafting is usually set at 300 revolutions, with countershafting at from 800 to 1,000 revolutions per minute, while the planer cylinders and the sticker heads travel at a speed of from 1,000 to 5,000 revolutions per minute. In some cases the speed in smaller machines, as for instance, carvers, reaches up to 9,000.

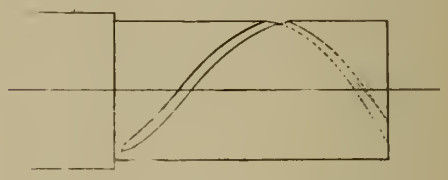
What with such speed careful lubrication and a good quality of oil is required to keep journals from heating, is apparent. Especially does this apply to vertical journals, out of which the oil will necessarily escape more easily.

Excessive friction and consequent heating will be caused by journals and bearings being out of alignment; by the babbit metal being cut owing to lack of proper lubrication, which causes the shaft to be out of true; loose bushings in wood pulleys, pulleys becoming out of balance, and the slip or "loose" pulley heating on the shaft. In well regulated factories the fire hazard from the causes just enumerated should be only slight. Defects in bearings are usually quickly remedied by the manufacturer to avoid waste of power and excessive wear and tear of machinery. But before all, any occurrence necessitating the stopping of main shafting, or even counter-shafting, would entail considerable pecuniary loss owing to the enforced idleness of the workmen till the defect is remedied.

Trouble from causes above enumerated are usually early detected by the experienced workman by easily discernible noises and by the smell from overheated oil.

Adjustable hangers and bearings and improved oiling arrangements have made the adjustment of bearings a comparatively easy matter.

The hazard from friction, therefore, is comparatively slight in a well regulated shop, where machinery is well looked after, and shafting, pulleys, etc. The case, however, is entirely reversed, where, owing to only partial occupation of the premises, as may occur, for instance, in tenant factories, or owing to the working of overtime of certain departments, a portion of the shafting is running in rooms not under the surveillance of competent parties: especially where dust is allowed to accumulate and get saturated with oil.



Spiral Oil Groove.

Conditions favoring a friction fire, with the added hazard of spontaneous combustion, exist where line shaftings are run in trenches or in dark basements, small counter-shaftings are located on the floor, boxed in and not easily accessible for cleaning and lubrication.

Belts getting out of repair, touching woodwork or slipping on wooden rims, will also cause friction. Rapidly moving belts will, especially in a cold and dry atmosphere, generate electric sparks strong enough to ignite wood;

this has been observed at as great a distance as eight inches from the pulley or belt. That it would be not too difficult a matter to have very fine wood dust or inflamable vapor thus ignited may be easily proved by a personal test. Stand on the wooden floor and present one finger to a rapidly moving belt from which you can draw sparks, point another finger to the gas as it issues from a metal burner, and the gas will instantly ignite. Moist air is unfavorable for this experiment.

## COAL SOLD ON NEW BASIS.

Marketing of Pittsburg coal will be revolutionized when plans now being perfected are carried into operation. Instead of basing the price on weight it will be based on the actual heat units the coal will produce. By this system it is believed it will take precedence over the coal of Ohio, Indiana and Illinois, and will command the price its excellence deserves.

The change is based on chemical analysis with the British thermal heat unit as the basis. It is a well determined fact that there is no guaranty for coal other than that determined by the heat units it will produce. A ton of 2,000 pounds may contain so much foreign matter that its usefulness for heat production is materially decreased when compared with a ton whose heat units are far above it. Different cars of coal from the same mine may vary in efficiency as a producer of heat, but as a general proposition the coal from a given mine may be depended upon to make practically the same showing.

This, however, is not true of different fields. The coal which lies between the Yonghiogheny and Monongahela Rivers is regarded as the best coal in the Pittsburg district, while that extending to the west of Pittsburg does not have the same heat producing qualities.

Analysis of river coal, as it is known, by the Carnegie Tech shows 14,000 to 14,700 British thermal units, which gives it a commanding place in the market when contracts are based on actual value rather than upon the general knowledge that Pittsburg coal is good coal. There have been mines in the district mentioned where the British thermal units show 15,000, but this is not general, and, therefore, is not taken as a basis.

### Use 13,000 as a Base.

For the sake of convenience Pittsburg operators are using 13,000 as a base and figure up or down from that, because at that point the value of coal is $2 when coal is selling at $2. This is also the grade of coal underlying Greene County, and when the new system of marketing the product of the mines to be opened in that section is inaugurated its value will be greatly enhanced, because of the premium it will have in the market over other competing coals.

As the coal measures of this section are traced westward the thermal units decrease steadily, although under the present system of marketing the product coals of Ohio, Indiana and Illinois are selling on almost the same basis as Pittsburg coal. Against the 13,000 and more thermal units of the river coal country Ohio districts show no more than from 11,500 to 12,500, practically taking away competition from those consuming interests which desire quality and do not care to pay freight on such waste matter as these coals contain.

Indiana is even worse, with a range of 12,139 to 11,061, while Illinois shows a range of 12,000 to 9,000 units. Yet these coals are selling in the market for practically the same price as Pittsburg river coal, when they should, under the graded system, bring from 40 to 50 cents a ton less.

It is the purpose of the local operators to follow the new order of things so they may receive the real value for what they market.

The Federal Government has been using the graded system for some time, and several of the corporations have recently placed it in operation. They want only such coal as will give them the desired heat units.

Under the old order, and in many instances under the existing order, superior coal is brought into competition with inferior coal. The buyer looks to the advantage to be gained by length of haul from the mines to the point of consumption, not considering that if the coal is not equal to or above the standard of 13,000 British thermal units he is paying for ash and moisture which do not enter into the making of steam. In this way Pittsburg operators have not only been deprived of trade, but they have been compelled to accept contracts at prices which they knew were below the value of their coal.

### Railroads Adopt System.

In this connection it is stated that some of the more progressive railroads, particularly those operating throughout the West, have come to Pittsburg for coal because they are unwilling to use coal of low standard, such as that found beyond the Mississippi. Anthracite coal is listed as the highest in quality because of its heat-producing qualities, but anthracite sells so far above bituminous coal that the best grade of the latter is more economical for railroad use.

The government is very careful to have its coal of high standard and tests each carload by the number of British thermal units it contains. If the coal falls below the standard set it is rejected, there being no qualification by which it can be taken at a lower price. This is particularly true of coal used in the navy and for the Panama Canal, as the government will not carry a lot of foreign matter which will not produce heat.

The Treasury Department has been purchasing coal on a heat value basis for several years with the most satisfactory results ever obtained. Other instances can be cited where heavy consumers buy coal by tested quality rather than by the ton, and are willing to pay for anything over the standard.

The movement for the introduction of this system in the Pittsburg district is now well under way, and operators predict that it will not be long until they are receiving a higher price for their coal.

## PERSONAL NOTES.

J. M. Robertson, for more than thirteen years with the Montreal Light, Heat and Power Company, or its predecessors, has resigned as mechanical superintendent and superintendent of shops and has established a consulting-engineering office at Montreal.

W. Woodroffe has been appointed acting general superintendent of the B.C. Electric Railway Company at Vancouver. He is an old employee of the company. The position of general superintendent, formerly occupied by Mr. Milne, has not yet been filled.

F. P. Brady is succeeded as general superintendent of the West Superior division of the C.P.R. by F. P. Gutelius, engineer-in-chief of the eastern lines. J. G. Sullivan, the present manager of construction, with office in Toronto, succeeds Mr. Gutelius. Mr. Sullivan was brought from the position of assistant engineer to the Panama Canal Committee a year and a half ago.

Mr. Matthew A. Sammett has severed his connection with the Montreal Light, Heat and Power Company, as engineer-in-charge of tests and design, and has opened an office at 702 Canadian Express Building, Montreal, as a consulting engineer. Mr. Sammett's work will embrace estimates, reports, acceptance tests, preparation of specifications for electric machinery, and supervision of plants for industrial enterprises.

# The Interpole System and Direct Current Machinery

## Influence of Interpole System on the Running of Direct Current Electric Motors and Generators—The Application of Interpole Machines

By EMIL STERN

To understand the topic of this discussion it is necessary to explain in a few words the action of the direct current system.

The motoric power of an electric dynamo is generated by an armature rotating in a magnetic field. The armature is an iron body closely wound with insulated electric conductors, rotating in a magnetic field formed of magnetic poles. The power lines travel from pole to pole crossing the iron of the armature in the shortest possible way. (See straight arrows in Fig. 1.) It is the crossing of these power lines during the turning of the armature which generates the current in the winding of the armature. The current is conducted to the collector, where it is transformed from alternating into direct current from the collector; brushes take it through the magnetic poles into the outer circuit, where it can be utilized. Fig. 1 shows the direction of the armature current, and the position of the neutral, where no power lines cross.

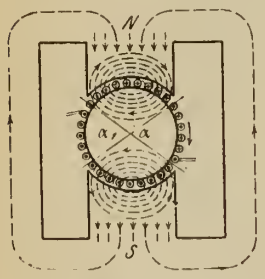



Fig. 1.

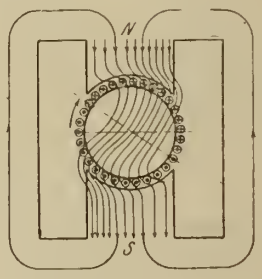



Fig. 2.

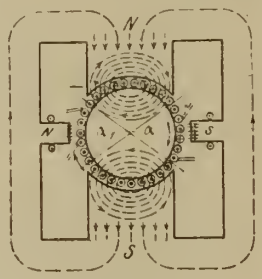



Fig. 3.

The power of the current depends on the number of power lines crossed in a second; the closer the power lines in the magnetic field, the greater the magnetic power of the poles, or the higher the speed of the armature;—the higher is the power generated by an electric dynamo.

As the efficiency of all good direct current generators is about the same, their reliability depends mainly on good transforming, consequently the commutator has always been their most sensitive part. When at first attempts were made to improve direct current dynamos, the cause of their faulty operation had to be discovered in the first place.

In every working armature electric eddy currents are generated, which will be considerably strengthened by the presence of iron in the armature. These currents, which are also generated around the poles, are marked by ovals in Figs. 1 and 3. Considering the direction of these eddy currents, it will be noticed that they are running against the power lines of the magnetic poles on one side, and running with the power lines on the other, consequently the magnetic field will be weakened on one side of the poles and strengthened on the other, as shown in Fig. 2, the field is cross magnetized. As a result the neutral section of the field is contorted and turns. The brushes, with an increasing load, have to be advanced on a generator, and set back on an electric motor. The position of the resulting magnetic field will vary all the time with a varying load, because the power of the eddy currents,—the cross magnetizing—will certainly increase with the strength of the current, which is taken from the armature. The result of this lengthy explanation shows that with old dynamos the brushes had to be carefully adjusted all the time, according to the load, especially when the field magnets were weak.

Attempts have been made to mend this fault by slotting the magnetic poles, this gave little or no satisfaction; better results were obtained by increasing the distance between the armature and magnetic poles, which again necessitated the strengthening of the magnetic field to bridge the increased air space. This fact has forced manufacturers to use cast steel largely for their magnet frame, instead of cast iron. The increased magnetic conductivity permitted of building machines in which the brushes had scarcely to be moved between full load and no load. The effect of cross magnetizing, however, had not been done away with, and resulted in a tendency of the brushes to spark when the load was changing rapidly.

### Interpole System.

All the faults mentioned above have been entirely done away with by the recent introduction of the interpole system. Fig. 3 shows the small poles, the so-called interpoles, which are placed opposite each other between the two main poles; they are magnetized by the main current of the machine, and are wired so that their magnetism acts in opposition to the cross magnetism. The strength of the cross magnetism depends on the strength of the current generated in the armature, and as this also surrounds the interpoles, it can be easily understood that it will paralyse the cross magnetism if properly dimensioned. This is the most feasible explanation of the interpole system, though other theories are in existence.

Fig. 4 shows how well the room in between the main magnet poles can be used for interpoles. Interpole machines will carry considerably more overload than old type machines. With a good interpole machine an overload of 100 per cent. or more will not cause the collector to spark. On the test stands machines have been overloaded so that the carbon brushes became white incandescent without causing the collector to spark. Interpole machines are especially suited for irregular and heavy work, as for cranes, hoists, tools, rolls, railways and elevators. As a matter of fact, rolling mills and similar works are entirely dependent on interpole machines for their electric drive, for instance, in a rolling mill one motor of 800 h.p. running load starts a set of rolls with over 100 per cent. overload, without any spark. The motor is of the interpole type, mixed compound and shunt wound; as a result of the winding the motor starts smoothly and the shocks to the main power station are very small.

Interpole motors are eminently suitable for speed variation, especially when shunt wound, their speed may be varied from 1 to 10, at an almost even efficiency at all stages. With the old type motors the magnet field could not be weakened very much, as the increased cross magnetizing would have caused the motor to spark.

Regarding motors of medium tension it has been impossible so far to use the same pattern for the same power. For instance, it was impossible to use the same pattern for 110, 220, 500 and 600 volts. With the interpole system the same pattern can be used for all tensions. Consequently, motors besides showing good workmanship, can be built at less expense and sold cheaper. How suitable these motors are, as reversible motors for the very heaviest work, as for electric locomotives, hoists and reverse rolls, may be seen from the following example: An instalation was made to drive a set of reverse rolls, to roll iron blocks of two tons weight into 18-inch I-beams. For this purpose a three-phase alternating current motor of 3,000 volts is direct connected to two direct current generators, and two fly-wheels of 26 tons. This motor consumes 1,000 h.p. steadily from the main power station. The motor which drives the rolls consists of three interpole motors coupled together, the armatures of which are wired in series;

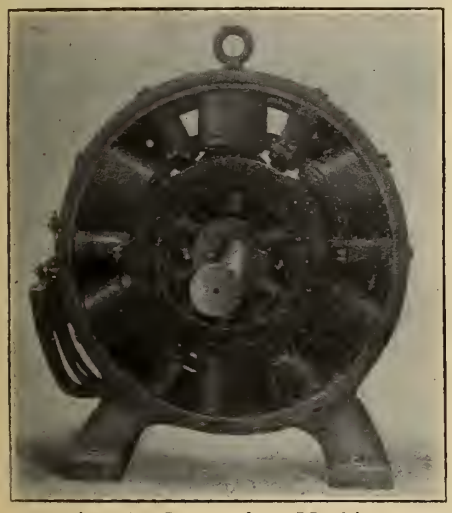


Fig. 4.—Interpolar Machine.

it takes the motors 2½ seconds to get up their full speed of 110 r.p.m. While rolling an 18" I-beam, which passes through the rolls 25 times, the variation in power of the motor which operates the rolls is 4,000 h.p.

The transformer and the system only show a variation of 50 k.w. or less than 70 h.p., up and down, which is insignificant in a 4,000 k.w. power station. The energy consumed per ton of rolled material is less than 20 k.w. hours. This article shows the advantages of the newly introduced interpole electric generators and motors, which are liable to strengthen again the direct current system in competition with the ever increasing three-phase alternating current.

All the large electric companies are now building interpole machines, and manufacturers should consider this when instaling new direct current motors and generators.

## CHATHAM PRODUCER GAS PLANT TEST.

Engineer K. L. Aitkin, Toronto, made an official test of the new municipal electric lighting plant recently installed by the Colonial Engineering Co., Montreal. This instalation consists of two 100 h.p. Hornsby-Stockport suction gas engines and producers. The engines may be used on natural gas or producer gas. They were installed in preference to one large engine.

The instalation of two engines has several advantages. If the electrical equipment is being driven with two engines, and an igniter should become dirty, there is a great advantage in the fact that this does not mean a complete shut-down (as it would with a single engine) but in this case means the cutting off, say, of one arc dynamo for a matter of two or three minutes while the lighter is being cleaned, after which the carrying of the full number of lights can then be proceeded with.

The engines show every evidence of proper design, good material and good workmanship. The hit-and-miss system of governing which is used, is standard English and Continental practice, and will be found quite satisfactory.

The following is taken from K. L. Aitken's report:

"In making a maximum capacity test on engine No. 25938, with natural gas I obtained 125 horse-power, and the engine then was running in such a manner as to be capable of delivering somewhere between 5 and 10 per cent. more than this amount.

"A similar maximum capacity test was made with producer gas, and 100 brake horse-power was obtained with 3 or 4 per cent. more capacity left in the engine.

"Engine No. 25939 showed a maximum capacity on producer gas of 98 brake horse-power.

"This guarantee for the large engine is that it shall not consume, at from three-quarters to full load, more than one pound of good anthracite pea coal per brake horse-power hour, and the quality of this coal, as stated under the specification for the producer, is 14,800 British Thermal units per pound. The coal which I found in the power house and used for this test, I have had analyzed and find that it has a considerably lower energy value than the above, and correction has therefore been made to compensate for this. On the combined test of the two engines I found that a horse-power hour was developed with .92 (92-100) pound of coal and therefore the two smaller engines have shown an efficiency 8 per cent. better than that guaranteed for the large unit."

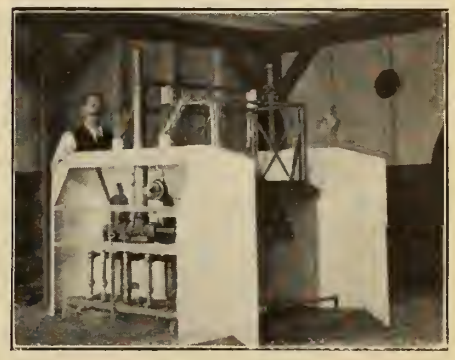
On natural gas the engines exceed the guarantee by 19 per cent. and 4 per cent. on producer gas. The coal consumption has been reduced by about 80 per cent.

## PONTOON WAVE MOTOR.

There is being exhibited in Toronto a model of a wave motor being built at Los Angeles by the Marine Power & Electric Co. It is the invention of George M. Wilson, a Californian engineer, and has been patented in twelve countries

In the construction of the device the pontoon principle is used and the whole is floated like a drydock when submerged. Between thirty-five and forty feet will be below the water line.

The whole is built on a sort of flat boat or base, 110 feet by 90 feet. Two pontoons run the length of this, their decks 20 feet wide by 55 feet deep. By filling these pontoons with water the whole is submerged to the proper depth. Four anchors will hold it. The pontoons parallel each other thirty feet apart. Between them is swung a large flat boat or barge, 75 feet long by 25 feet wide and 8 feet in depth. Chains attached to the base and six pitmans connected with as many crossheads keep it in place, at the same time allowing it perfect freedom with the waves. Besides getting the full force of the swell ordinarily, the pontoons are slanted in such a way as to even increase the wave pressure. The power will then be communicated direct to eighteen submerged hydraulic pumps. These, in turn, raise the water from the ocean to three immense receivers, from which it will connect with a dynamo and generate the electricity, which will be transmitted by submarine cables to its destination.



Model of Pontoon Wave Motor.

The pontoons will be constructed with pointed bows like those of a boat, which will point seaward. The space between the pontoons at the bows will be fifty feet and between the main bodies thirty feet.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

### A TALK WITH OUR READERS.

Each month we intend giving a number of practical articles of use to engineers. The November issue has a number of pages of these and we are on the lookout for more of this material.

Have you any special methods or devices that you find useful in the engine or boiler room? If you have, write to us about it in your own words. Illustrate, if possible. The sketch may be rough, but we will attend to that. If your article is acceptable we will arrange it for publication and pay you liberally for it.

The only stipulation is that the article must give a useful idea. It may be an old device that you have not thought worth writing about before, but it may be just the thing another engineer or fireman is looking for. Address, The Power House, 10 Front St. East, Toronto, and it will reach the editor.

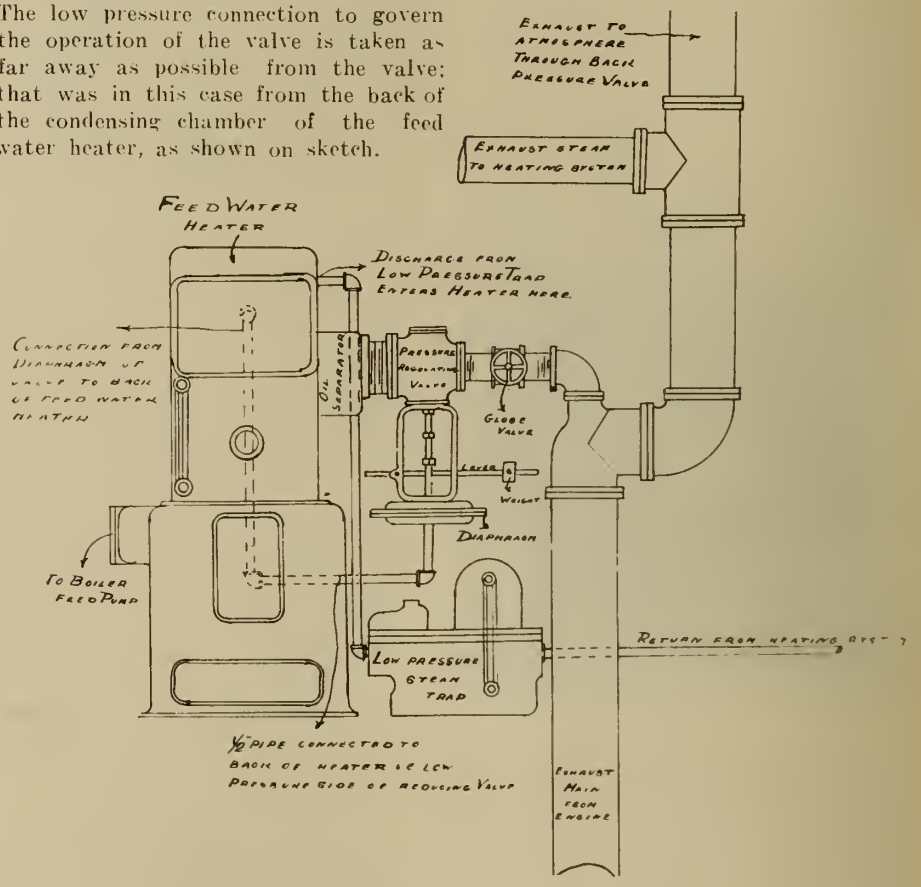
### DISPOSAL OF HEATING SYSTEM RETURNS.

In installing a heating system in a large factory recently I came across the following proposition the solution of which may interest some of your readers in charge of plants operated on similar lines.

In the instalation to which I refer the heating of the factory was by means of blast coils, through which the cold air was drawn by a fan and distributed throughout the various air ducts. Exhaust steam was used for heating the coils, and a back pressure of five pounds was carried on the engine. The returns from the blast coils were led into a low pressure steam trap and from thence discharged into an open feed water heater of the "no thoroughfare" vacuum type.

When the system was laid out, evidently no thought had been taken of the fact that the same pressure existed in the feed-water heater as was present behind the low pressure steam trap. In consequence when the plant was started up, the steam trap failed to discharge the returns from the heating system into the feed-water heater, owing to there being an equalization of pressure. Fortunately the feed-water heater was of the "no thoroughfare" type, i.e., there was only a branch connection taken to it from the main exhaust pipe, of sufficient size to supply the exhaust steam necessary to raise the feed water to 210 degrees F. With another type of heater the following arrangement could not have been adopted, which was found to be perfectly successful.

The exhaust inlet to the heater was 4 inches. I procured a 2"x4" pressure regulating valve of the diaphragm type. This valve is constructed with an independent diaphragm of large area, is extremely sensitive and will respond to the slightest fluctuation of pressure. The low pressure connection to govern the operation of the valve is taken as far away as possible from the valve; that was in this case from the back of the condensing chamber of the feed water heater, as shown on sketch.


Exhaust to Atmosphere Through Back Pressure Valve
Exhaust Steam to Heating System
Feed Water Heater
Discharge from Low Pressure Trap Enters Heater Here.
Connection from Diaphragm of Valve to Back of Feed Water Heater
Oil Separator
Pressure Regulating Valve
Globe Valve
Lever
Weight
Diaphragm
To Boiler Feed Pump
Return from Heating System
Low Pressure Steam Trap
½" Pipe connected to back of heater is low pressure side of reducing valve
Exhaust Main from Engine

Disposal of Heating System Return

The pressure regulating valve was set to reduce the pressure of five pounds carried on the exhaust main down to two pounds in the heater, thus enabling the steam trap to discharge the returns from the heating system against the lower pressure carried on the feed-water heater.

The operation of the reducing valve under such conditions was more or less an experiment, but the makers assured me that it would do the work. Under a prolonged test and up to the present time, which is three weeks since the change was made, the arrangement outlined above has worked perfectly. The variation of pressure in the feed-water heater was not more than half a pound at the most, and this was due to the condensation of the exhaust steam, in the feed-water heater tending to form a vacuum. The temperature of the boiler feed water leaving the heater averaged about 205 degrees F, the minimum being 200 degrees F.

The accompanying sketch shows the method of connecting up the pressure regulating valve as outlined above.

### FIRING FOR RESULTS.

By H. H. Ward.

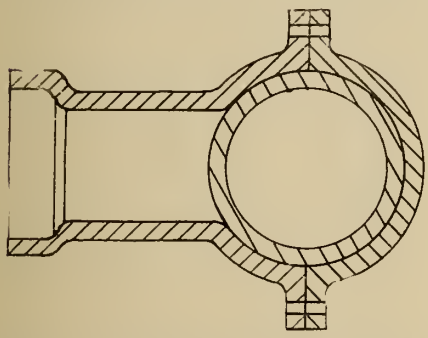
To obtain the best results in firing with hard coal screenings, it is a good plan to fire in small quantities—that is, to fire often and lightly. Wetting the coal and keeping it damp, will give better results and a cleaner, brighter fire.

I would advise using the poker as little as possible, for it only makes your fire dirty and full of clinkers. Regarding the amount of water in the glass, I would say that it is better to have only about

two and a half or three inches showing, for in this way you make it easier work, use less coal, and have your steam much drier. The more dry your steam is, the better the results obtained. The engines will run better and there will not be so much condensation if you have to shut down for a time. Of course a fireman has to study his fire and the particular boiler he has to keep steam up in, for nearly every boiler has a peculiarity of its own, which, to get the best results out of, must be known to the man in charge—or else he will find it hard to keep the steam up to the mark.

## MAKING A PIPE CONNECTION.

Making a connection to a water pipe without lowering the pressure is rather an interesting operation. In making the



Section of Special Casting Fitted Over Pipe.

connection of an eight-inch pipe at Lindsay, Ont., this was done successfully by J. Howard Bridge, without depriving the town of their water supply. The work is usually done by closing down a pumping plant for a couple of hours, but this was accomplished in this case while the water in the pipes remained at its usual pressure.

A special casting, shown in section in the illustration is clamped over the place where the connection is to be made. An extension with a gate valve is leaded securely and in front of this is bolted a plate. Through the centre of this plate is a hole through which extends a cutter shaped like a carpenter's extension bit. The centre part is in the form of a screw and screws into the iron pipe while the extension bit cuts a piece out of the pipe. This cutter is worked by a ratchet wrench. When the piece of pipe is cut it is drawn out close to the plate. The screw enables the operator to do this. The piece cut out is slightly less than the valve, so it draws through the valve easily.

During the operation the gate valve is open. After drawing the cut piece of the pipe to the plate the valve is closed. The plate is unbolted and the piece of pipe is removed. This is not a new idea of Mr. Bridge's but was used by him at Lindsay.

## RESETTING SLIDE VALVES OF WORTHINGTON PUMPS.

By H. T.

A simple way to reset valves on Worthington pumps is as follows: First remove the steamchest covers, and then move one piston to extreme of stroke and note position of steam valve on the other pumps—that is, the amount of steamport opening. The piston should now be moved to the other end of stroke, and the amount of port opening measured again. If the two ends are equal, the valve is set correctly. If not, the valve must be moved on the spindle by an amount equal to one-half the difference, which will give equal port opening at both ends of the stroke. The same process must be repeated for the other side of the pump. In this class of pump the manipulation is with one piston and the opposite valve.

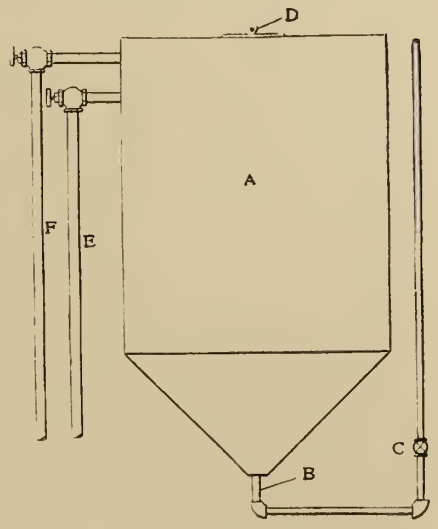
## BOILER COMPOUND FEEDER.

By F. B. Fiedler.

The accompanying sketch is a boiler-compound feeder, designed by myself, and as there is no patent right on it, any engineer may build one and use it.

Referring to the sketch, A is a tank to mix and hold the liquid, B is a ¼-inch steam pipe from the boiler, C is a stop cock to regulate the steam supply, D is a 3-inch plug to open and close the tank, E is a ¾-inch pipe to convey the mixture to the suction pipe of feed pump, F is a pipe to regulate the pressure between A and a return receiver tank from which the feed pump gets its supply.

In order to start the feeder, pour about 5 gallons of water into the tank




A Boiler Compound Feeder.

A, which holds about 10 gallons of water. Then put the amount of compound it is intended to feed per day into the water, close the tank by screwing in the 3-inch plug, and open the stop cock C just enough to bring the water in the tank to a very slow boil. Then open the angle valve in the pipe E and the feeder is ready to operate. The pipe F is not necessary when pumping from an open tank.

It will be found when opening the tank A, after, say, twenty-four hours' run, that there is just about as much water in the tank as there was the previous day, but it is clear water, the compound has all gone through pipe E in a diluted form, and all one has to do is to put in another supply of compound and close the tank up again.

The steam entering the tank through the pipe B serves a double purpose, i.e., to mix the compound with the water, and to supply all necessary water in the form of condensed steam, and the faster steam is admitted, the faster the feeder will feed, although it is advisable to feed as slowly as possible to get the best results.

The feeder should always be higher than the water supply, so as to feed by gravity. This feeder will feed any compound.—Power and Engineer.

## POSSIBLE ECONOMIES IN LUBRICATING OILS.

By Walter B. Snow.

The analysis of lubricating greases is a rather complicated procedure, and one which yields little information as to whether the sample is suitable for the purpose to which it is to be applied. It is possible, however, by determinations of the water and the ash present in greases to give important information regarding the presence of foreign materials. The variation in these constituents is clearly displayed in the following table from a report by Arthur D. Little, the Boston chemist. Designating letters have for obvious reasons been substituted for the actual names of the samples:

| Designation. | Cost. Cents. | Water. P.C. | Ash. P.C. |
|---|---|---|---|
| A | 8 | 2.48 | 4.56 |
| B | 11 | 7.45 | 0.62 |
| C | 4 | 20.50 | 1.92 |
| D | 7 | 4.84 | 5.54 |
| E | 16 | 1.53 | 1.53 |
| F | 1¾ | 1.18 | 7.68 |
| G | 5 | 2.45 | 2.46 |
| H | 6 | 0.72 | 2.20 |
| I | 6 | 1.22 | 3.69 |
| J | 6 | 1.04 | 1.65 |
| K | 5 | 1.43 | 4.34 |
| L | 7 | 0.96 | 2.73 |
| M | 15 | 2.64 | 2.28 |

These greases are, on the whole, of very good character, only one containing an excessive amount of water, but

Mr. Little considered the prices excessive, and advised that six cents per pound was as high as need be paid. He further stated that the samples were practically all of greases made with a small amount of soap as a hardener or solidifier. In some of the cases an alkali soap was used, while others contained a lime or alumina soap.

A recent investigation of the quantity, quality and cost of oils used by various mills indicates conditions so varied as to point the moral of the value of expert advice in their purchase. In this case the chemist, Mr. Arthur D. Little, of Boston, by whose courtesy the results and conclusions are presented, found a range in the cost of machine, engine and special oils (exclusive of cylinder oils) from 14 to 48 cents per gallon, as appears from the following table:

| Name. | Price. Cents. | Sp. Gr. | Flash. | Fire. | Cold. |
|---|---|---|---|---|---|
| Machine .... .... | 14 | 0.872 | 399 | 464 | 36 |
| Machine "A" ... | 16 | 0.872 | 388 | 462 | 36 |
| Machine .... .... | 14 | 0.926 | 329 | 361 | 28 |
| Machine .... .... | 15 | 0.932 | 352 | 385 | 17 |
| Engine ... ..... | 23 | 0.914 | 410 | 470 | 8 |
| Engine "B" .... | 25 | 0.661 | 414 | 467 | 8 |
| Special engine ... | 48 | 0.907 | 405 | 446 | 10 |
| Signal oil ..... | 45 | 0.845 | 265 | 283 | 30 |
| Crank case ..... | 18 | 0.677 | 514 | 590 | 29 |

The real value of the oil is shown by the constants revealed by the investigation. With qualities almost identical there is material variation in the price, as, for instance, between the first and second samples and between the different engine oils. Mr. Little's opinion, based on extended experience in similar cases, was that 12 cents per gallon would be a fair price for these oils, taken as a whole. At this figure the mills investigated would be able to save nearly $1,200 per year by the use of the cheaper oil without detrimental results.

## RULES FOR THE ENGINE ROOM.

By Canuck.

1st.—When you enter the engine room, spit on the floor. We have water, lye, soap and brushes, and we will clean up as soon as you leave.

2nd.—Rub your hands on the polished work, it will give some one work to use the surplus polish.

3rd.—Put your hands on the engineer's bright work, you will know whether it is smooth, hot or cold. Tell others to do the same.

4th.—Stop in the engine room as long as you please. The engineer has nothing to do but entertain visitors.

5th.—Be sure to tell the engineer that his engine is pounding or not running right, as he will not know unless you do; he will stop and make repairs while you wait.

6th.—Don't tell the engineer who you are, he is a mind reader and always knows who you are. Go anywhere in the engine room and you will please him.

7th.—Advise him what to do, as you know best. The engineer is only there every day and does not have a chance to see as much as you will in an hour.

8th.—When the engineer is busy making repairs, tell him a good story and if possible get in the way.

9th.—Be sure and tell him all you know, it will not take long.

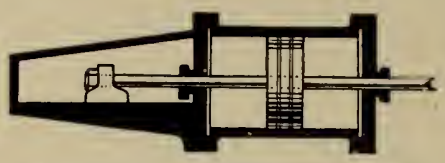
10th.—Call again and repeat as long a story as you can.

11th.—Pull out a cigar and light it, don't ask him to have one for if you do he will accept it.

## POUNDING AND CYLINDERS.

By George A. Wilkie.

I have been annoyed for some time with a disagreeable pounding in two 18x19-inch and one 16x16-inch engine cylinders of which I had charge. These were getting worse all the time especially on the outer end of the cylinder. I decided upon examination that the pounding was due to the dragging of the piston on the bottom of the cylinder, causing unusual wear on the piston which showed about 3-32 inch loose from the cylinder. Upon being calipered found it that amount out



A Cure for Pounding in Cylinder.

of round, whereas the cylinder was worn so little that I could hardly measure it with the calipers.

This dragging of the piston on the cylinder also kept the piston rings from working free, thus allowing a bad leakage of steam past the piston. To get over this difficulty I decided to have a tail bearing put on the outer end of the cylinder. I then had a new piston made with a tail rod and with the bottom half of crosshead attached so as to slide on the tail bearing. This kept the piston centered, at all times allowing the rings to work free and do the work they were intended to do. The arrangement shown in the sketch with the extension babbited shoe or crosshead effectively cured the knocking. A new piston rod was of course necessary and a new head was made for the cylinder with a stuffing box. The rod is fastened to shoe with nut keyed to piston rod. The box over the shoe is covered but accessable. The covering prevents any splashing of oil.

Since making the change last April I have not had any of that pounding and the engines are running more economically, carrying heavier loads on less steam. This is shown by the indicator cards taken frequently since last April. What is more pleasing to the proprietor is that the coal consumption has fallen off between 2½ and 3 tons per day of 24 hours, compared with the corresponding period last year and carrying the same load.

## BOILER-ROOM ECONOMICS.

One of the ever-present problems in central-station operation is the delivery of the kilowatt-hour of electrical energy at the bus-bars with the minimum consumption of fuel, and so far as the operating eagineer is concerned, this problem is the most difficult of solution, while at the same time yielding a return for any conscientious time expended on it. Before the problem can be dealt with properly, it is necessary to have some record of the units generated, together with the coal and water used, and in most stations these data are easily procurable. The losses that are taking place should then be sought out, and an endeavour made to find whether they are due to low boiler efficiency, steam losses, excessive steam consumption, etc. If a station is being operated with very great losses, wonders may be worked in a short time; but not many stations are being thus operated, so that increased economy is obtained gradually and only after a careful study of conditions. Much time is also required for making tests and determining whether a certain performance can be bettered; and, inasmuch as the average engineer has not many leisure moments to devote to such work, it may be weeks before these preliminary matters have been cleared up. The subject may be divided for convenience into the following headings: Fuel analysis, fuel-gas analysis, auxiliary apparatus, feed water, firing, superheating, load factor, and radiation.

It is essential for obtaining the best results that a straight run of coal should be used, as nothing is so inimical to economical steam generation as the frequent changing of the quality of coal. Firemen, if supplied with a certain line of coal, can in time learn to burn this to the best advantage. A carload of coal from one mine and a carload of coal from an entirely different mine should not be the rule for purchasing fuel. Coal from one mine should be used if good results are to be expected from the average fireman.

The quality of the coal should also be ascertained by repeated tests on carload lots. Not infrequently one finds a station buying the cheapest slack on the market, presumably on the assumption that any deviation in the quality

of the fuel will be in its favor. Calorimetric tests of small quantities of coal, while offering some basis of comparison, are not of great commercial value, since the value of bituminous coal, for instance, is augmented by the hydrocarbons contained in it, and a large proportion of this escapes up the chimney without giving up its heat. Evaporative tests under similar conditions yield the best practical results.

In order to make a complete analysis of the gases from a boiler, the temperature, draught, and chemical constituents should be known. By means of this information the chimney losses may be reduced to a minimum, and apparatus for determining these points is available on the market. To obtain the maximum efficiency the quantity of excess air must be as small as possible, and this quantity can only be determined by individual tests, and depends upon the quality of the fuel and also on the available draught. As much oxygen as possible should be combined with the carbon to produce carbon dioxide. For all practical purposes the amount of carbon dioxide produced is an index to the state of combustion. Theoretically, without excessive air, 19 per cent. of carbon dioxide will be produced; but in everyday work one might with reasonable attention obtain 12 per cent., with an exit stack temperature of 600 degrees F. Many stations are equipped with recording apparatus for ascertaining this percentage, and in most cases satisfactory results are obtained that have justified the original outlay. Without some such apparatus it is not possible to keep a close watch on air leakages. Many boiler settings are notoriously porous, and being subjected to great changes of temperature, the air leakage becomes excessive unless constant attention is directed to its restriction. Air leakages, unlike steam leakages, do not show themselves, as the leakage in the first place is from without, whereas the leakage in the latter case is from within.

When boilers are shut down under natural draught, there is always air leakage in the main flue, even though the dampers are closed, says a writer in the "Electrical World." The brickwork around damper frames will generally be found to allow considerable air to pass through. This air has a cooling effect on the chimney gases and decreases the draught. If economisers are used, it also means that their efficiency is lowered. Unless all such leaks are stopped, any recording carbon dioxide apparatus is of little use.

The auxiliary apparatus consists of stokers, coil-handling apparatus, feed pumps, condenser equipment, etc. The stokers, coal and ash conveyers, etc., should, as a general rule, be electrically driven, since steam engines for this purpose are inefficient. The question of electrically driven or steam driven feed-water pumps is open for discussion. If an electrically driven pump is installed because of its higher efficiency, a steam driven pump should be provided as a stand-by in the event of any failure of the electric supply.

Feed-water purification may or may not be essential, but feed-water heating is important. Many engineers have an erroneous opinion as to the detrimental effects of scale in boilers. While scale does not materially reduce the efficiency of a boiler, it may increase the wear and reduce its life. The steam-making power of a boiler plate depends not on its conducting powers, but on its receiving and transmitting powers. An iron plate can conduct twelve times as much heat as it can absorb from the fire or give up to the water, and it is quite possible that a thin coat of scale on the metal in the water and a deposit of soot on the metal in the heated gases may be a benefit rather than a detriment. The nature of the scale is of course important, and unless it is many times as bad a conductor as the iron, the same amount of heat will pass, so that the question resolves itself into its ability of handing over the heat received to the water. A thin scale is preferred by many experienced engineers, who hold that this scale not only stops corrosion and pitting, but makes the boiler steam better. If, however, much scale-forming material is present in the water, this should be removed before the water is fed to the boilers. In every case where water is treated the treatment should be done externally to the boiler, since it is the function of the boiler to raise steam, and not to act as a purifier.

When the engineer has checked all the leakages in the brickwork, has affixed gauges to the stack so as to record the amount of carbon dioxide present, and has done all that can possibly be forseen to effect economy, the problem then must naturally rest with the fireman. The latter should be instructed in the proper method of firing the particular fuel used, and so much has been written on this subject that it would appear that advantage could be taken of the abundant material available.

The station with a large output and high load factor naturally shows better economy as to fuel consumption. If the output of a station is below normal the conditions are not conducive to economy. If the load factor is such as to require banked fires in the boiler room, an effort should be made to improve the load factor. The effect of a bad load factor is more pronounced in the boiler room than in the engine room, since a standing engine does not waste coal, but a banked fire does. The number of boilers under steam should therefore be kept down to a minimum and some method of increasing the draught installed to help out at peak loads.

Radiation from all sources should be reduced by covering all heat-radiating surfaces with non-conductors. Nearly all stations have their live steam pipes enclosed in some steampipe covering, but not all heat-radiating surfaces are covered, so that economy in this direction is only partially obtained.

By means of superheated steam, a saving of from 10 to 20 per cent. may be effected in the fuel expense, the greater saving being realized when the engines are working under uneconomical conditions or where the steampipe lines are very long. While a superheater may reduce the efficiency of a boiler somewhat, the saving in steam more than offsets this loss of efficiency; so that if superheated steam requires 10 per cent. additional heat and reduces the engine losses by 20 per cent., a material saving is effected.

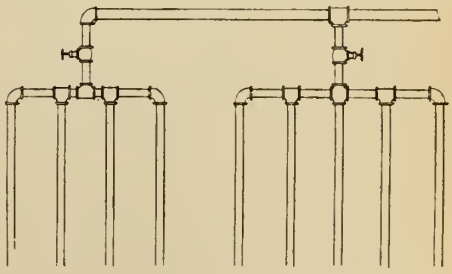
## UNIQUE PUMP INSTALATION.

The propeller pump installed in the "Mystic Rill," Dominion Park, Montreal, referred to on page 32, October issue of The Power House, was designed by W. C. Brown, engineer for John McDougall Caledonia Iron Works, Montreal.

## CHANGEABLE WEATHER HEATING ECONOMY.

By O. B. Wilmarth.

When heating is done by live steam a good deal of coal is wasted during the transitory months of the year when warm and cold weather alternate. When a hot day comes suddenly, all the windows are opened and the boiler in the power house



Arrangement of Pipes and Valves.

helps heat outdoors. A scheme has been put into effect at our new plant (the Grand Rapids Hand Screw Company), whereby the addition of a valve, a couple of elbows and a short piece of pipe, steam can be turned into four, five or nine lengths of piping according to the weather. As shown in the sketch, each bank of pipes is divided into two sections—consisting of four and five pipes respectively.

When the weather is very cold both

sets of pipes can be operated. In milder temperatures steam can be turned into four or five pipes. Three different degrees of heat can therefore be obtained by the addition of two valves and a little extra piping. The first cost is insignificant compared with the coal-saving possible in changeable weather. The piping in the plant is hung on the walls near the floor and the valves are located conveniently near doorways.—Factory.

## USE OF STEAM AT VERY HIGH PRESSURE.

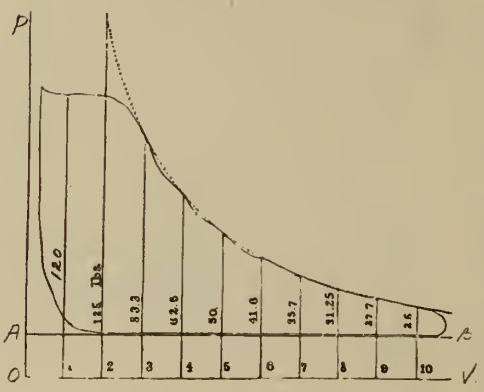
By Leon Creux.

It has been shown experimentally that steam, at a temperature of 500 to 600 degrees and with a consequent pressure of as high as 1,422 lbs. per square inch, can be used for generating power; but in order to do this two important difficulties have to be overcome—(1) that of generating the steam; and (2) that of lubricating the cylinder walls. In the apparatus, the boiler or generator is of the flash type, and is composed of a number of elements, each consisting of four parallel tubes placed one above the other and coupled together by bends in such a manner as to form one continuous length. The lower end of each element is coupled to a feed-water pipe which is common to all, and the upper end to a steam receiver which is also common. The bottom pipes, one for each element, form the crown of the furnace, and they are kept at a dull-red heat. The feed water, having previously passed through an economizer, is forced into the bottom tubes at a pressure of 28 to 56 lbs. per square inch above that of the steam, through a tortuous orifice which causes it to be projected along the hot generating tube in the form of spray, a condition in which, owing to its finely divided state, it will very readily absorb heat. The remaining three tubes of each element are more of the nature of superheaters, the true vaporization having been almost completely effected in the bottom tube. The fact that all the elements are "in parallel" is advantageous from many points of view, not the least being the facility with which any element can be isolated. The steam pressure is regulated by that in the feed-pipe, as, should it rise above this, no water can flow into the heated tube, and thus no further steam can be generated until the pressure again falls. Turning to the second difficulty—viz., that of lubrication—it is found that if the oil be kept from contact with either air or steam it retains its lubricating properties even when heated to the very high temperature in question. In order to keep the oil thus sealed up, annular grooves are cut in the piston. The oil in the simplest case—i.e., a single-acting cylinder—is forced into a groove near the end of the piston on which the pressure acts, and as the piston reciprocates, it travels particle by particle towards a similar groove near the other end, whence it is drawn off for re-use. The saving of a machine working at 426 lbs. per sq. in. as compared with one of similar power working at one-third of this pressure is computed as 25 to 29 per cent. The diminished weight per horse-power of the high-pressure machines is of especial moment where questions of transport over rough country arise.

## MEAN EFFECTIVE PRESSURE.

In the accompanying indicator card, AB is the atmospheric line drawn by the pencil of the indicator when the steam connections with the engine are closed and both sides of the piston are open to the atmosphere.

The vacuum line, OV is a reference line drawn 14.7 lbs. by scale below the atmospheric line and represents volume. The clearance line, OP is a distance from the end of the diagram equal to the same per cent. of its length as the




Finding M.E.P.

clearance is of the piston displacement, and represents pressure.

The mean height of the diagram equals its area divided by its length. The mean effective pressure is the mean net pressure urging the piston forward, equals the mean height multiplied by the scale of the indicator spring.

To find the mean effective pressure from the diagram, erect ten ordinates, as shown, beginning usually with half a part at figure 1, and half a part at 10. That is, divide into ten spaces and erect the ordinates in the centre of them. Add together the lengths of the ordinates intercepted between the lines of the diagram and divide by their number, usually ten as in this case. This gives the mean height, which multiplied by the scale of the indicator spring gives the M.E.P. A quick way to measure the M.E.P. is to use a ruler scaled in tenths. Thus if a 60 spring is used, a sixty scale is necessary. By having a piece of tracing linen with these ordinate lines traced out, trouble of drawing the lines each time is eliminated. Set the tracing over the indicator card with the atmospheric lines coinciding, and read directly. Thus:

| | |
|---|---|
| Ordinate 1 | 120.95 |
| 2 | 125. |
| 3 | 83.3 |
| 4 | 62.5 |
| 5 | 50. |
| 6 | 41.6 |
| 7 | 35.7 |
| 8 | 31.25 |
| 9 | 27.7 |
| 10 | 25. |
| Total | 603.00 |

Then dividing by 10 the M.E.P. is 60.3.

## HORSE-POWER CONSTANT.

The horse-power constant is found by multiplying the area of the piston in square inches by the length of the stroke in feet, and this by the number of strokes per minute and dividing by 33,000.

$$\frac{L \times A \times N}{33{,}000} = \text{H. P. constant.}$$

where

L=length of stroke in feet.
A=area of piston or cylinder in sq. in.
N=number of single strokes per minute or R.P.M. $\times$ 2.

To get the horse-power multiply by the mean effective pressure in lbs. per sq. in. Thus the formula for H.P. becomes:

$$\text{H. P.} = \frac{P \times L \times A \times N}{33{,}000}$$

where P = the mean effective pressure in lbs. per sq. in.

To be accurate, one-half of the sectional area of the piston rod should be subtracted from the area of the piston if the rod passes through one head, or the whole area of the rod if it passes through two heads.

## AMUSING BLUNDERS OF A MECHANICAL ENGINEER.

By Wm. Westerfield.

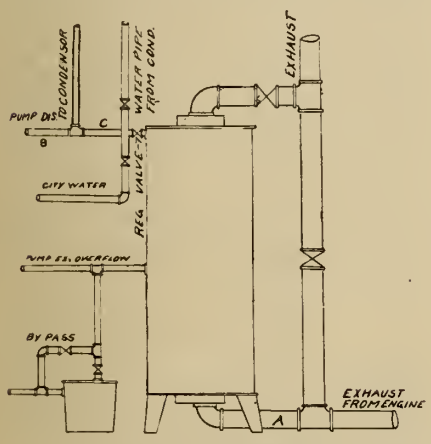
The best of men make mistakes sometimes. A man who never made a mistake never accomplished very much. The following, reprinted from The National Engineer, illustrates the need for great care in engineering:

I recently had the pleasure (and some fun, too) of inspecting a refrigerating plant just installed and about (as was supposed) ready for operation. I think that there are some things in this plant that are not usually found in power plants for any purpose, and thinking that a description of them may

be edifying, and also somewhat mirth-provoking.

In reading the description given, and the statements herein contained in general, I wish to state with all the vehemence that is at my command, with the use of types, that I am in no wise related either nearly or distantly to Ananias of ancient fame, and that the statements are absolutely and undeniably true.

In the rough sketch herewith is a plan of the connections to the feed water heater. It was desired to arrange a by-pass for the exhaust so that the heater could be cut out if desirable without shutting down. It will be seen that to accomplish this a valve would be required at A in the plan, as it will be impossible to prevent steam from blowing through the heater even when the by-pass is open without a valve placed here. This we will call blunder number one. I think this proposition is too simple to require much thought on the part of mechanical or operating




Connections to Feed-Water Heater.

engineers to enable them to see the error.

It was desired to use a common trap for the heater overflow, and this was done, but instead of giving it a chance to do its work it was connected up as shown with a by-pass, and the exhaust steam from three pumps enters the overflow pipe as shown. It will be clear to anyone that one of two bad things will have to be done; that is, the by-pass will have to be left open, or if not the pumps will be exhausting into a closed pipe except when the trap opens to discharge water. Now if the by-pass is left open the trap is inoperative, and if it is not left open the pumps will not run. If the trap is cut out in order to run the pumps the money spent for it might as well have been saved.

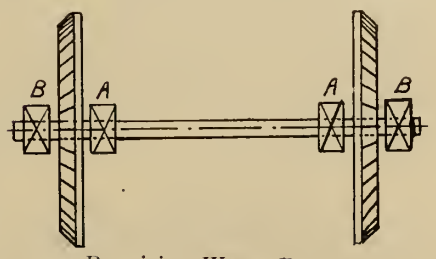
Also by leaving the by-pass open the heater will be open directly to the atmosphere, and as a back pressure valve is to be used for exhaust steam heating in Winter, this will be a disadvantage. Again it will be noticed that as the pump exhaust is connected into the overflow pipe, the exhaust steam in this pipe will prevent the proper discharge of water through it to relieve the heater of any excess, and in my opinion this is liable to cause flooding of the engine.

Water is to be delivered to the ammonia condensers by a triplex pump, discharging through pipe B, to which is also connected a supply pipe for the heater, and into this is connected a city supply pipe, and also a pipe from the waste basin of the condensers, and it is the purpose to use the water from the condensers to supply the heater. It will be noticed in the plan that there is no valve located at C, where it should be, as otherwise there is no way of cutting apart the water to and from the condensers, and as the return pipe has a head of six feet less than the delivery pipe, it must be clear that the triplex pump will deliver water to the waste basin of the condensers, instead of allowing it to return by gravity to the heater.

This article is headed "Amusing Blunders," but I must say that these blunders are not really amusing, but are serious. At first thought the ridiculous appeals to us, and we forget the danger of allowing such persons to direct the instalation of power plant equipment. These things to which I call attention indicate ignorance of the subject that is dangerous. It may cause loss of property, or, what is worse, loss of both life and property.

## REPAIRING A WATER PUMP.

A water pump installed in a pumping station was constructed in the manner shown in the accompanying sketch. The designers made the bearings at A A very light, and only four inches wide. As long as there was a light load, it ran all right, but the demand for water increased and the pump was run to its capacity. Under the added stress the shaft bent and after that gave a great




Repairing Water Pump.

deal of trouble until it was repaired by putting bearings at B B.

A stout beam was built beneath the floor and to this the bearing was bolted and made rigid. There was enough overhang at B B so that a new shaft was not necessary. After adding the extra bearings there was no further trouble with the pump.

## AUTOMATIC INJECTOR INFORMATION.

By Frank O'Leary.*

In the selection of an injector, the prime consideration must be the selection of a machine best suited to the conditions under which it is to work. Relating the manner in which injectors are classed as positive, automatic, lifting and nonlifting, a confusing impression is conveyed of there being many types of injector. An automatic injector may be a lifting or nonlifting machine, according to its construction; so a positive injector may be a lifter or nonlifter. Therefore, there are but two distinct types, automatic and positive. While a lifting machine might work under nonlifting conditions, or a nonlifting machine work on a very short lift, their usefulness would be limited as compared to their service were they connected in their proper condition.

A lifting injector is constructed to be used where the pressure of the atmosphere alone overcomes the weight of the water, forcing it upward into the constantly forming vacuum caused by the condensation of steam in the instrument.

A nonlifting injector is designed to be used where the water flows to the injector, as from tanks above, from city mains etc. More generally the requirements are for lifting injectors. There are accordingly more of this class manufactured than of the non-lifting type, consequently the lifting injector is more frequently erroneously applied to nonlifting conditions, than is a nonlifting machine to lifting conditions. There is no remedy which may be applied to a nonlifting injector that will make it work satisfactorily when used where lifting is required.

A lifting injector properly constructed, working under average boiler pressure, say 100 pounds, should deliver to the boiler 12 to 16 pounds of water per pound of steam used. It is plain that with the combined pressure of the atmosphere and its own weight, a greater volume of water will flow downward into a partial vacuum than the weight of the atmosphere alone is capable of forcing upward in the same vacuum, when it is considered that in the latter case the weight of water acts against the atmospherie pressure. Therefore, by applying the lifting injector to nonlifting conditions, it is apparent that the

*Mechanical engineer of the Penberthy Injector Company.

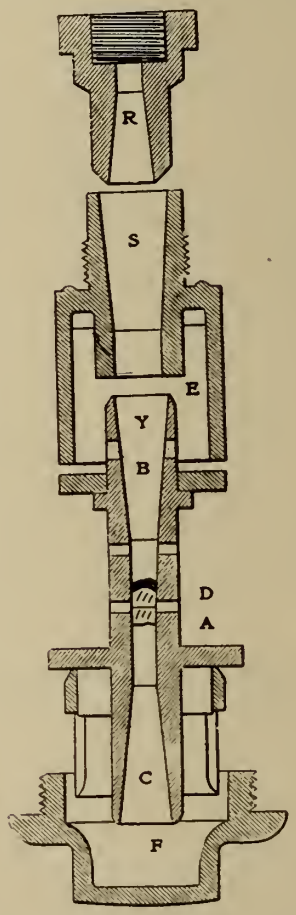
amount of steam used will be practically unchanged, while the volume of water will be much greater, the result of which is a disproportionate amount of water for the steam power of the injector to force to the boiler. Since many a good injector has been condemned for no other reason than that it was applied to conditions other than for which it was designed, and that thoughtless selections are the prime cause of trouble to the engineer and manufacturer, let the inexperienced in selecting an injector advise the representative manufacturer, should his conditions be different from those taken to illustrate the general instructions in catalogues.

The very small proportions of the injector in comparison to the work it performs, immediately suggests to the considerate engineer that the prime parts of the device must necessarily be of delicate and precise dimensions and that he must exercise his mechanical knowledge to connect the instrument to the boiler in a careful and workmanlike manner. When the piping is accurately fitted, steam should be blown through to carry out scale and pieces of cuttings, which are sure to be in a new pipe arrangement. The suction or supply pipe from the tank or other source from which the injector takes water, is the line which gives the most trouble. This is due to the fact that when the injector is connected to lift, the only pressure on this pipe is the air pressure on the outside, the force of which is inward. This pipe will not show leakage, because it is leaking air in, not water out, and since it does not show leakage, the engineer often assumes it to be tight. It is therefore desirable to be careful in screwing up this pipe, so that it will be known to a certainty that it is tight.

### Why Injector Often Fails to Work.

To illustrate the most annoying and frequent reason why the injector fails to work, refer to the accompanying sectional view of an injector, showing steam-suction and delivery tube, which may be used as a general example. It will be seen at A, in the delivery tube Y, that the inlet taper B and the outlet taper C extend into a straight bore at which point the highest velocity of the water is attained. This is the smallest bore in the instrument. Particles of pipe cuttings, coal or gravel coming from the steam or suction pipe would find their way through the wide tapers of the suction jet S and through the contracting taper B of jet Y, until the smaller area of bore at A would block their passage, when this bore and the spill holes D would be stopped up, as shown.

If on first trial the injector fails to work, or if the injector has worked and suddenly stops, the engineer would remove tube Y, hold it endwise to the light and examine this particular point A, and would almost surely find that it had become plugged. When the tube is found to be stopped up, a small wire may be run through the bore and tapers, which will push the obstruction out. The wire should be entered at the end of the tube E and pushed through toward end F. Often the engineer removes this tube and closely examines it on the outside, but neglects the inside; seeing nothing wrong, the injector is considered defective and returned for repairs, only for the manufacturer to discover the jet stopped up. Too much care cannot be taken to keep the injector clean and free of lime.



Vertical Section Through Injector.

### Injector Test.

It may be interesting to consider a practical demonstration of the operation of a Penberthy automatic injector in the shape of a test made with a DD-21 machine, having a 1¼-inch pipe connections. The injector was connected to the boiler in the usual manner, but with the delivery pipe arranged in such a way as to permit the attachment of an equalizing valve through which the water, after overcoming boiler pressure on the valve, was delivered to a tank placed on platform scales. The intake pipe was so attached as to average a lift of 3 feet from a tank, also held by platform scales. This tank contained sufficient water for the test, the temperature of the water being 70 degrees Fahrenheit. This method permitted an accurate computation, as, before the discharge from the injector could reach the receiving tank, it was necessary for the injector to overcome boiler pressure existing on the equalizing valve. The boiler pressure throughout the test was 100 pounds gauge, and the duration of the test was five minutes, which is ample time from which to compute an average performance.

### Weight of Water.

In the five minutes the injector had taken from the supply tank 646.59 pounds of water and had delivered into the receiving tank 692.04 pounds. The temperature of the water was increased in its passage through the injector from 70 degrees to 147 degrees Fahrenheit. The difference between the weight of the water taken from the supply tank and that delivered into the receiving tank was due to the addition of the condensed steam used by the injector; this amounted to 45.45 pounds, and the quantity of water delivered per pound of steam used, was

$$\frac{646.59}{45.45} = 14.224$$

To move the ratio correct and to ascertain something of the velocity of the steam and water through the injector, we will reduce the water to cubic feet, noting its weight and volume at the temperature at which it was taken and at which it was delivered. One cubic foot of water at the temperature 70 degrees Fahrenheit weighs 62.35 pounds; the amount taken, 646.59 pounds, would equal as many cubic feet as the number of times it would contain the weight of 1 cubic foot, which is

$$\frac{646.59}{62.35} = 10.3769$$

cubic feet. By the application of heat, the water in its passage through the injector has been raised from the temperature 74 degrees to 147 degrees, at which temperature 1 cubic foot of water weighs 61.24. The 646.59 pounds as delivered would equal

$$\frac{646.59}{61.35} = 10.5582$$

cubic feet.

The expansion would be determined by

subtracting the volume of 646.59 pounds at a temperature of 74 degrees, from the volume 646.59 pounds, at a temperature of 147 degrees, which is

$$10.5582 - 10.3769 = 0.1813$$

cubic foot. Therefore, without adding to its original weight, the water taken has been increased in volume 0.1813 cubic foot.

### Weight of Steam.

Including steam used and condensed in the operation, the total weight of water in the receiving tank is 692.04 pounds, which weighed at a temperature of 147 degrees, equals a volume of 11.3004 cubic feet. To find the number of pounds of steam used, subtract the volume of supply (10.5582 cubic feet), as it was delivered to the receiving tank, from the combined condensation and supply (11.3004 cubic feet)

$$11.3004 - 10.5582 = 0.7422$$

cubic foot. We have, therefore, used in the performance a volume of steam equal to the weight of 0.7422 cubic foot of water at the temperature of 147 degrees. The weight of 1 cubic foot of water at the temperature 147 degrees being 61.24 pounds, 0.7422 cubic foot would weigh

$$61.24 \times 0.7422 = 45.45$$

pounds of steam used.

### Velocity of Steam.

To determine the velocity of steam through the steam tube into the injector, refer to a table of weights of saturated steam and find that at 100 pounds gauge pressure, 1 cubic foot of steam weighs 0.2617 pound. The number of pounds used in this test would thus be

$$\frac{45.45}{0.2617} = 173.6721$$

cubic feet used.

The diameter of bore through which the steam entered this injector was $\frac{3}{8}$ inch, which diameter equals a square area of 0.1104 inch. A cubic inch of steam, in order to pass through a $\frac{3}{8}$-inch bore, would transform itself into a jet $\frac{3}{8}$ inch in diameter by 9.0579 inches long. To pass a given point in a $\frac{3}{8}$-inch bore, a cubic foot (1728 cubic inches) of steam would travel

$$1728 \times 9.0579 = 15,652.05$$

inches, or dividing by 12, would give 1304.3376 feet. As, during the test, 173.6721 cubic feet were used, the total travel may be found by multiplying 1304.3376, the travel of 1 cubic foot, by the total cubic feet, 173.6721, which will be

$$1304.3376 \times 173.6721 = 226,527.05.$$

feet. The duration of test being five minutes, or 300 seconds, the velocity of steam through the bore will be determined by dividing the number of feet of travel by the time; thus,

$$\frac{226,527.05}{300} = 755.09$$

feet per second, which is the velocity with which the steam enters the injector.

The diameter of bore through the section of the combining tube where the combined steam and water attains the highest velocity in the machine is 7 millimeters, which diameter closely approximates 9-32 inch, the area being 0.062 square inch. A cubic inch of water to pass this bore would take a form 9-32 inch in diameter by 16.129 inches long. As the amount of delivery was 11.3004 cubic feet, or 19,527.0912 cubic inches, the total travel through this bore would be found by multiplying 19,527.0912 by 16.129 inches, which equals 314,952.454 inches, or 26,246.0378 feet. The duration of the test being 300 seconds, the velocity may be found by dividing the travel by the time, or

$$\frac{26,246.0378}{300} = 87.486$$

feet per second, which is the velocity of the water through the combining tube of the injector. This means that the injector is overcoming and feeding into the boiler pressure at this point at the rate of nearly 87½ feet per second.

## HAVE YOU DIFFICULTIES.

Some times you may have difficulties in the power plant, and you are not sure of the proper method of overcoming them. If so, write us about it. State your trouble as clearly as possible and we will publish it in the next issue of Power House. Your name will not appear if you wish it withheld.

We will ask other engineers to answer the problems and discuss the questions that arise in the power plants. In this way you will be able to obtain the practise of engineers who have overcome the difficulty.

Address Power House, 10 Front St. East, Toronto, and your letter will reach the editor.

## CORRESPONDENCE.

Editor of "The Power House:"

Dear Sir,—Being a subscriber of one of your magazines, and thinking this might interest your readers, I give a startling experience. In the office where I am employed in one of the rooms a wet towel was placed (or I may say was thrown there by some person) on one of the shelves just underneath an electric light which was alight. On the shelves were a number of cardboard files in which were letters and papers of all sorts. I left the room for a little while. Imagine my surprise on coming back to see smoke coming from the room and on looking closer to see the towel ablaze and the files almost burnt. The bulb was very black and the curious thing about it was, the bulb had in it a very big dent but it gave a light. Perhaps this is the cause of quite a few fires. I concluded the heat from the light had scorched the towel and then set it alight.

Hoping to hear from you soon, I remain yours,

T. E. BOYCE.

---

Editor The Power House, Toronto, Ont.

Dear Sir,—While reading The Power House I notice you ask your readers to write to the paper, stating practical or technical experiences, either from a point of view of imparting knowledge, or to have a question discussed. I should like to put before your readers a question which came to me while making recent experiments.

It is a known fact to all that energy cannot be lost, and it is upon this data that I wish to put my question:

Supposing a copper spring was wound into a high state of tension, and then bound by a material which is not acted upon by sulphuric acid. The whole spring is then immersed into strong sulphuric acid, a chemical action will immediately take place (i.e)

$$Cu + H_2SO_4 = CuSO_4 + H_2.$$

The action continues uniformly until the spring has reached the thickness of a hair, and finally is all dissolved simultaneously. I want to ask your readers if they would give me their solution, as to where the energy has gone which was imparted into the spring in the first place? I am,

Yours truly,

GEO. B. HEDBEN.

## LUBRICATE A LITTLE.

One of the nicest ways to put an engine or a dynamo out of commission is to put sand or emery powder in the oil cups.

Friction will do the rest.

If it wasn't for the lubricant you couldn't run an engine five minutes.—Silent Partner.

---

Seventy pounds, absolute, steam pressure will flow through an opening 1 inch square into the atmosphere at the rate of 1 pound per second.

# Power Plant of the Canadian Locomotive Co., Kingston*

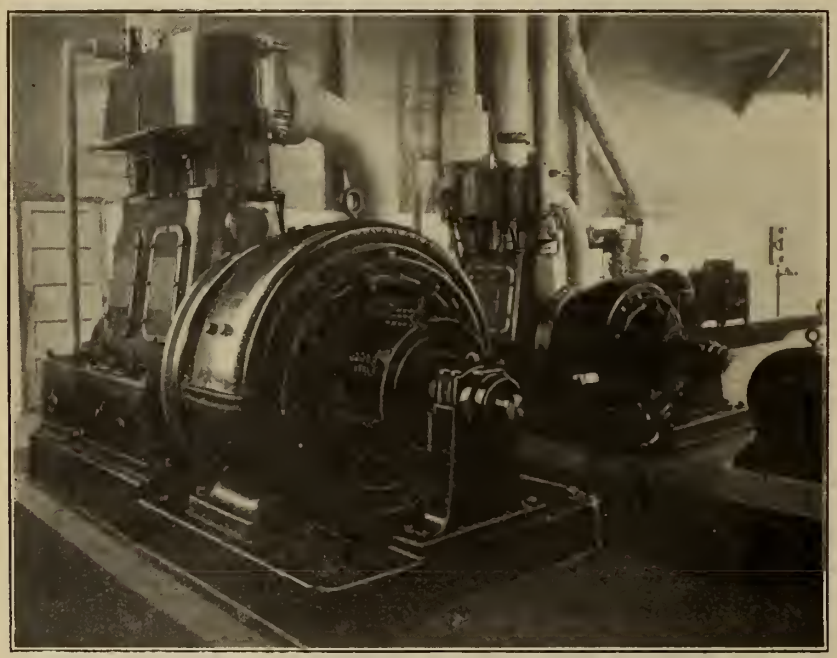
## The Equipment, Including Engines, Boilers, Stokers, Feedwater Heater, Pumps, Heating System, Air Compression, Etc., with a Test of the Plant.

By HENRY GOLDMARK, E.E.

The boiler plant consists of three Wickes boilers, with Foster superheaters and Murphy stokers, and a Buffalo Forge Company induced draft plant.

The pump room contains the Webster feed water heater, separate pumps (in duplicate) for boiler service and general shop supply, and a large fire pump.

In the engine room there are two Belliss and Morcom engines direct connected to Westinghouse generators, two air compressors, and a Worthington barometric condenser connected with both engines and compressors. The room also contains a balancer set and the switchboard, and is served by a 5-ton hand-power traveling crane. There is sufficient floor space to permit of the instalation in the future of three more vertical boilers, an additional engine of somewhat greater capacity than the larger of those now in place, and another compressor, as shown in Fig. 2.



Engines and Generators in the Canadian Locomotive Co.'s Power Plant.

Boilers.—The boilers are of the Wickes Vertical Water Tube type, and designed for a pressure of 150 pounds per square inch. The rated capacity of each is 250 horse power, with a water heating surface of 2,510 square feet, and a grate surface of 42 square feet, so that the ratio of water heating surface to grate surface is 60. These boilers consist essentially of two drums, connected by vertical tubes. The drums are 78 inches in diameter, the lower, or mud drum, being 53 inches long, and the upper, or steam drum, 100 inches. There are 112 four-inch tubes. The upper drum has a well-stayed head with one large manhole and a smaller hole directly over each tube, the latter to enable tubes to be readily inserted or withdrawn.

These boilers were bricked in more heavily than customary for this type, there being 16 inches of common brick lain in cement, and an inner layer of fire brick, with an air space of 2 inches between them. The flue is covered with heavy asbestos insulation.

The boilers are fitted with Foster superheaters of sufficient capacity to give 150 degrees F. superheat. They are fastened to the front of the boilers just below the steam drum, the superheated steam pipe passing between two adjacent boilers to reach the main header.

The Wickes boiler having no combustion chamber immediately below the boiler, requires the addition of an exterior furnace or Dutch oven. This was utilized for the instalation of Murphy Stokers. The magazines are at present filled from above by an air hoist traveling on a runway over the stokers, but a light trestle extending to the outdoor coal pile is to be substituted, permitting small dump cars to run directly over the stoker magazines.

The induced draft plant is in duplicate, each half being able to supply draft very easily for the three boilers now installed, while the two fans are of sufficient capacity to handle six boilers at moderate speed. The fans are 92 inches in diameter, connected with 7"x12" horizontal engines. A somewhat novel feature are the concrete foundations, about eighteen inches high, supporting the fan engines and absorbing the vibrations very fully.

The pump room contains one 12"x7"x10" Blake Duplex outside-packed boiler feed pump, and one 7½"x5"x6" Worthington boiler feed pump; also one 10"x7"x12" Northey Duplex water service pump, and one 16"x9"x12" Northey fire pump, with priming tank. In the pump room is also located the 1,500 h.p. Class E. O. Webster Star vacuum feed water heater.

Condensers.—The condensing plant was built by the John MacDougall Caledonian Iron Works, of Montreal. It consists of a Worthington ejector condenser, with cast iron discharge pipe and entrainer, supplied by an 8-inch Worthington circulating involute pump driven by a Robb engine. The condensing plant is designed to be of sufficient capacity for the power plant, as enlarged in the future to the full capacity of the building. The exhaust riser is 20 inches in diameter, the condenser tail pipe 10 inches in diameter. There is also a Knowles 6"x12"x10" air pump. Both pumps are steam driven and located in the engine room, as shown in plan.

Engines.—The engines are of the vertical quick-revolution type, built by Messrs. Bellis & Morcom, of Birmingham, England, and were erected by Messrs. Laurie & Lamb, of Montreal. They are cross compound, double crank, two-cylinder, vertical, enclosed double-acting, self-lubricating engines.

The larger unit has a capacity of 365 B.H.P. at 350 R.P.M. The diameter of the high pressure cylinder is 15 inches, and that of the low pressure 24 inches, with an 11-inch stroke. The smaller unit is of 145 B.H.P. capacity at 475 R.P.M. The high and low pressure

*From a paper read before the Mechanical Section, Can. Soc. C.E., October 29, 1908.

cylinders are of 10" and 16" diameter, respectively, with an 8-inch stroke.

For the larger engine the floor space occupied by the set is 13' 6"x6', and the height 10' 3". For the smaller unit the floor space required is only 10' 9"x1' 6", with a height of 8' 1".

Generators and Switchboards.—The generators were built by the Canadian Westinghouse Company, at Hamilton, Ontario. They are direct connected to the engines, and mounted on a common base. The capacity of the units is 250 kilowatts and 100 kilowatts, respectively. They are compound wound for 240 volts, and are of the Westinghouse Standard make in other respects.

The switchboard was built by the Westinghouse Company. It is Vermont marble, and contains three generator panels, one lighting panel and balancer set panel, and one total light-measuring panel; one power panel, with circuit breakers, and one total power-measuring panel. Recording watt meters of General Electric make, and Westinghouse registering ammeters, are used on the power and light totalling panels.

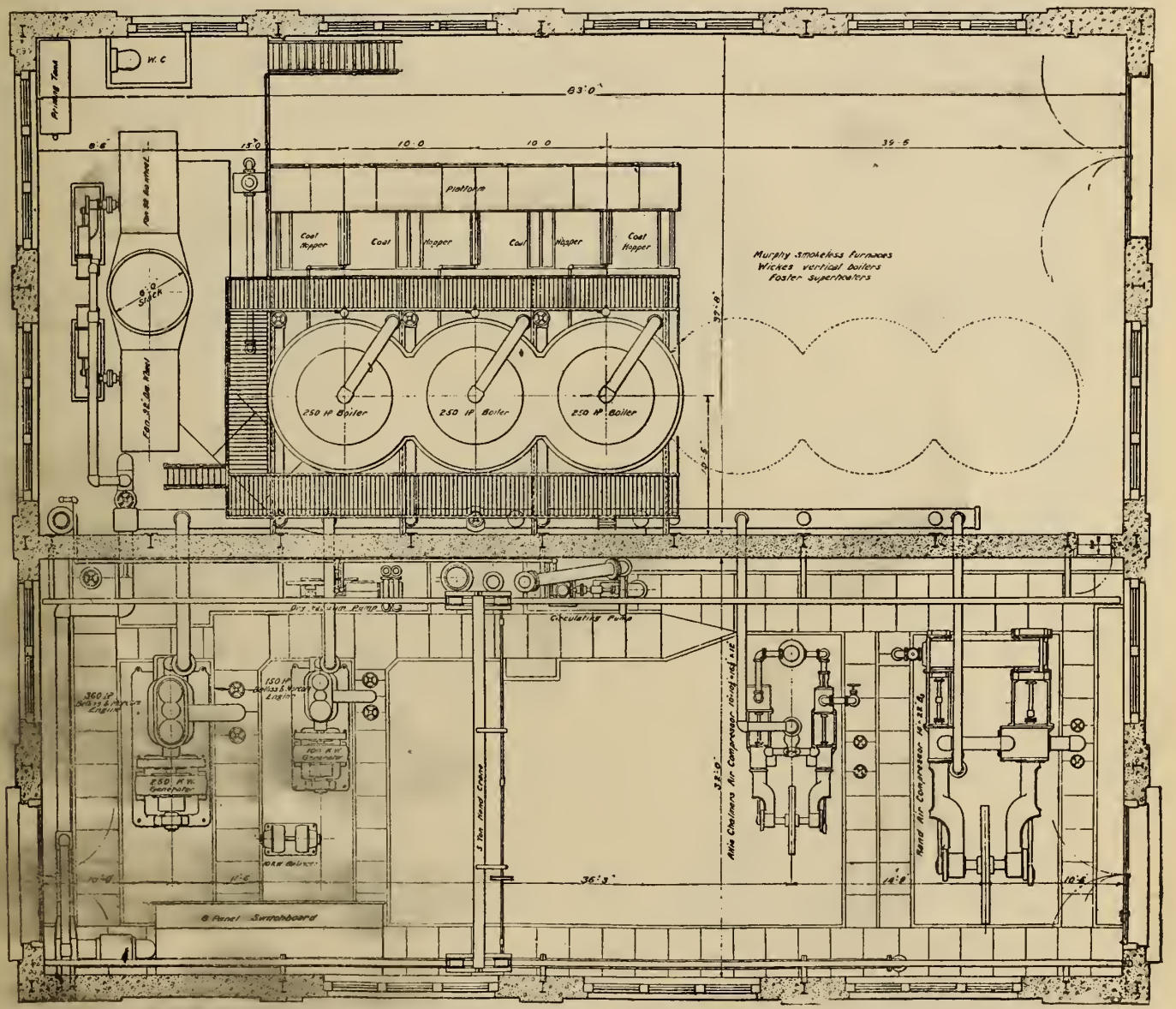
There are two air compressors. One of them is of the Ingersoll-Sergeant type, built by the Allis-Chalmers Company; has duplex steam cylinders, 10" diameter, and two stage air compression cylinders 10¼" and 16¼". The stroke is 12". Its capacity is 444 cubic feet of free air per minute.

The second compressor was built by the Canadian Rand Company. It is compounded for both steam and air. It has a stroke of 22", with high and low pressure steam cylinders 14" and 24", and air cylinders 14" and 22", respectively. The normal speed is 105 R.P.M., and its capacity at this speed is 1,209 cubic feet of free air per minute.

Tests of the Power Plant.—With the kind co-operation of Profs. Gill and Willhofft, of Queen's University, Kingston, and their students, careful tests of the boilers and of the entire plant were made. The object of these tests was to determine the efficiency and economy of the plant under the conditions of actual operation. These tests may be briefly summarized:

**Boiler Test.**

Duration, 10 hrs.....Object, economy
Water heating surface.2,500 sq. ft.
Grate surface ..... 42 sq. ft.
Murphy stokers.
Fuel—
Kind of coal.....Youghiogheny stock.
Thermal value of dry coal.13,133 B.T.U.
Percentage of moisture in coal...5 P.C.
Percentage of ash and refuse referred to dry coal.....12.6 P.C.
Dry coal burned per sq. ft. of grate surface per hour.....24.8 lbs.
Draft and Temperature—
Draft in furnace .....0.264 in.
Flue gas average temperature..530° F.
Water and Steam—
Average temperature of feed water ..... .....66.8° F.




Arrangement of Power House Equipment at Canadian Locomotive Power Plant.

Average steam pressure (gauge) ..... 146.8 lbs. per sq. in.

Superheating—

Average temperature of steam. 523.5° F.
Average amount of superheat. 159.5° F.

Economic Evaporation—

Water actually evaporated per pound of dry coal..... 8.07 lbs.
Evaporation from and at 212° per pound of dry coal corrected for quality of steam..... 10.42 lbs.
Evaporation from and at 212° per pound of combustible corrected for quality of steam..... 11.93 lbs.

Horse Power—

Rated H.P. of boiler (10 sq. ft. heating surface = 1 H.P.... 250 H.P.
H.P. developed by boiler.... 292.6 H.P.
H.P. equivalent of boiler and superheater ..... 314.8 H.P.
H.P. in excess of rating 64.8=25.9 P.C.
Efficiency of boiler and furnace ..... 76.6 P.C.

**Economy Test of Station.***

Duration, 11 hours.

Larger Belliss & Morcom engine (365 B.H.P.) and 250 kilowatt generator running; also Rand compressor. Both running condensing. Two boilers fired.

Steam used per I.H.P. per hour, including auxiliaries..... 28 lbs.
Net (omitting auxiliaries).. 23.2 lbs.
Percentage of total steam used by auxiliaries ..... 14.6 P.C.
Dry coal per 1 H.P. per hour, including auxiliaries ..... 3.24 lbs.
Dry coal per 1 H.P. per hour, net corrected for drips..... 2.67 lbs.
Evaporation from and at 212° F. per lb. of dry coal..... 10.27 lbs.
Thermal value of fuel..... 13,133 B.T.U.

**Distribution of Heat, Light and Power.**

The live steam, exhaust, and compressed air pipes from the power house to the different shops are housed in by a wooden covering and supported on a structural steel trestle, which also carries the electric circuits.

All heating is done by direct radiation except in the machine shop, where a fan blower, driven by an electric motor, has been installed. All steam for heating is distributed at low pressure, exhaust steam being used when ever possible. The water of condensation flows by gravity to three receivers placed in pits below floor level, and is returned to the boiler plant by Bundy pumping traps.

The power distribution is at 240 volts on a two-wire system, while the lighting is taken care of by separate three-wire circuits—240—120 volts.

Cooper Hewitt mercury vapor lamps are used in the machine shop, foundry, and boiler shop: arcs and incandescents in the other shops.

The motors are of Westinghouse make, and are for direct current at 240 volts.

Excepting a number of the large machine tools, which are fitted with individual compound-wound motors, the plant is arranged in group drives, with shunt-wound motors. There are some series motors on the cranes and elevators.

The total horse power of the motors now installed is 821 H.P., in sizes varying from 6 to 60 H.P., and speeds from 500 to 1,675 R.P.M.

*The plant was not complete. There was no lagging on the steam pipes. There was no superheat at the air compressor, and on y 40 degrees F at the large engine. The average load factor on the plant during the test was about 45 per cent. The average efficiency of the engine and generator was 86.5 per cent.

# 21st Annual Banquet Toronto Branch C.A.S.E.

**The Banquet, in Point of Instruction and Attendance, a Great Success —The Question of the Technical Education of Engineers was Fully Referred to and Many Suggestions Made for its Development.**

The twenty-first annual banquet of the Toronto No. 1 branch of the Canadian Association of Stationary Engineers was held in the Walker House, Toronto, on Nov. 6, 1908. The speeches clearly showed that the aims of the association are educational in nature. A committee consisting of F. Stubbs, president; W. C. Tait, chairman; M. Kerr, sec.-treas.; Chas. Moseley, John G. Bain, J. W. Marr, W. C. McGhie, Jos. Hughes, W. E. Archer and H. E. Terry had charge of the arrangements and the attendance which was about 175 showed the success of their efforts.

F. Stubbs, president, occupied the seat of honor and around him at the head table were grouped the speakers of the evening. The list of speeches opened with a toast to Our King, "A man of sovereign parts, he is esteemed." This was followed by "Canada Our Home." In reply, Ald. J. H. McGhie referred to the great country of Canada and the large developments which are going on. These afforded great opportunity for young men for advancement and they must develop with the requirements of the country. The opportunities are at hand. It is for the young man to see the opportunity and make his ability suit it.

Song. Robert Wilson.

Dr. J. M. Harvey, Montreal, also speaking to our country, referred to the Association as progressive engineers. His father had developed the first steam turbine but he did not have a patent and others took it up. He said he was an educationalist. Just as there were grades of mechanics so there were engineers farther up the ladder than others and he was pleased to see that the C.A.S.E. intended grading engineers. He hoped that all would work patiently and faithfully to become a first-class engineer. Keep the education going on. Take John Watt as an example. When an old man he studied the Anglo-Saxon grammar. There is a dignity in labor and honor for the man whose brow is wet with the sweat of honest toil.

Let this Association be a brotherhood of progressive engineers, were the keywords of his remarks. All meet on a common ground in Canada. It is a great country. Young men will be true patriots when they get at the fundamental facts of knowledge, and will build up a nation that will last. We shall then all sing joyfully together, The Maple Leaf Forever.

**Corporation of Toronto.**

Controller Harrison was the first to reply and mentioned that 300,000 people in Toronto depended on 25 engineers.

Toronto is a university city with schools and colleges. There is one technical school but instead of being governed by the school board he thought that it should be in charge of a board of engineers as was previously the case.

Jack Armour, of New York Power and the Engineer, entertained the gathering combining the sublime and the ridiculous. He recited "Be the Fellow Your Mother Thinks You Are" and concluded with a song "Yes, She Does." As an entertainer "Jack" is without a peer.

Ald. W. J. Sanderson extended the good wishes of Toronto to the C.A.S.E., referring to Toronto as a city of homes. There must be something to keep these homes together and the educational institutions will place the families of engineers and others in a better condition that stand for higher living and a great unity.

Song. James Hanna. Flow Gently Sweet Afton.

Among the more important speeches of the evening were those dealing directly on technical education. Principal R. H. Eldon, Toronto Technical School, was present and pointed out that only

as we perfected our technical educational institutions could Canadian manufacturers hope to compare with those of foreign countries. The courses at the Toronto Technical School include general culture courses and three-year courses, specializing in electricity, drafting, preparing men for machine shops. There are also business courses fitting young men for office work an art course for designing, etc.

Technical education is not known as it should be. It should come more to the front. Not one-quarter of high school students enter the professions and the other three-quarters should be considered. The culture course should be kept up but the schools should reach out along practical lines as well.

Wm. Kirkland, professor in steam engine design at the Toronto Technical School, referred to the great drawback experienced in the teaching of steam engine theory and practise, owing to the lack of equipment. Technical schoo's are not to turn out artisans but to help an apprentice in mechanics and the theory of the steam engine thus assisting his usefulness to the manufacturer and winning for him advancement. What is required is mechanical laboratories to illustrate lectures. Various forms of engines flexible pumps, heating plant, etc., are needed so that students might become familiar with an engine, boiler and electrical apparatus.

A technical school is not under commercial conditions and therefore cannot teach a trade but can co-operate with a manufacturer by assisting anyone desiring advancement.

### Manufacturing Interests.

John Main, Polson Iron Works, said that the C.M.A. had taken steps toward the compilation of standard specifications for boilers. It is hoped that in the near future all the provinces would adopt similar laws. As it stood now Montreal and British Columbia have their own laws while Ontario has practically none.

### Executive Council.

The C.A.S.E. is on the right course, said Chas. Kelley, Chatham, executive president, when speaking of technical education. He had been an engineer for twenty-seven years and still had much to learn. New devices to secure greater economy were being placed on the market and a man must keep posted on these mechanisms to be a practical engineer.

W. A. Crockett, executive secretary, Mount Hamilton, took a broad view of the work to be done by the C.A.S.E. There should be technical education for all that wanted it. The C.M.A. when in convention in Montreal set aside $5,000 to investigate technical education. A broad scheme of practical education is necessary.

W. Norris, London, answering the toast of Sister Societies, said technical education for all must branch out and encircle Canada.

Dr. J.M. Harper. Montreal.
"Give me the man who sings at his work"
Controller Harrison, Toronto
"A 'political' engineer should not be on the Technical School Board"
W.C. McGhie
looks on from the end table
Chairman Stubbs
enjoins "order"
W.C. Tait
a busy man, enjoys a quiet cigar
Charles Kelly, President
"A man must keep posted to be a practical engineer"
W.A. Crockett
"There should be Technical Education for all who want it."
H.E. Terry
Past President
enjoys the proceedings

### INDICATOR—CARDS.

A. W. Marr dispensed happiness during the evening—Smoke up boys!

Executive President Kelley belongs to the Practical Engineers.

The engineers' new society name—Progressive Engineers.

A neat souvenir in the shape of a napkin ring was beside each plate. It was made of Red Radium High Resistance Packing, manufactured by Gutta Percha & Rubber Mfg. Co. To it was attached a ribbon bearing the date of the C.A.S.E. banquet.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### COMMUTATOR GRINDER.

Something altogether new on the Canadian market, and one which fills a long-felt want, is the commutator grinder.

The machine can be fixed to a dynamo in fifteen minutes, and the commutator trued up, without the risk of damaging the edges of the bars or of dragging the mica.

The grinding spindle is driven direct by means of a specially prepared rubber friction wheel running on the commutator, so that no external source of power is required. The spindle is carried by a long slide and is absolutely rigid.

The bearings are of great length, and the spindle and drum are balanced so as to run at the required high speed without vibration.

When running the grinding spindle moves to and fro across the face of the commutator and is automatically reversed at each end. It is so constructed that stops can be set as in a planing machine, grinding the commutator right up to the connecting wires and back to the edge. All the attendant has to do is to watch the feed.

Hand feed machines are designed to true up commutators up to 12-in. diameter and 10-in. face for commutators of larger size automatic feed machines are recommended. The frames of the machines are so constructed that they may be readily fixed to almost any make of generator. Fig. 1 shows the machine itself and Fig. 2 is the machine ready for work.

The machines are made in three sizes:

(1). Light hand-feed. To true up commutators from 3-9-in. diameter and 6-in. face.

(2). Heavy hand-feed. To true up commutators of any size.

(3). Automatic feed. Will true up any sized commutator at present in use.

The latter was used on a commutator eight feet in diameter with success. The machines can also be easily fixed to a lathe bed, for the purpose of grinding up commutators of motors used for street railway work. Grinding wheels can be supplied specially insulated when it is required to true up live commutators.

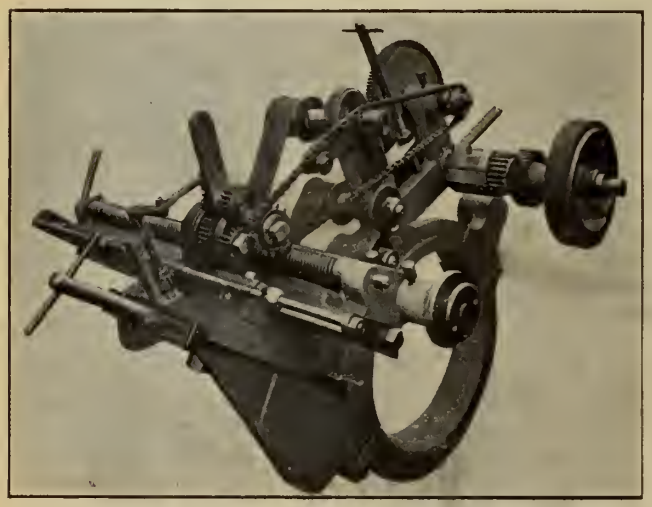


Fig. 1.—Commutator Grinder.

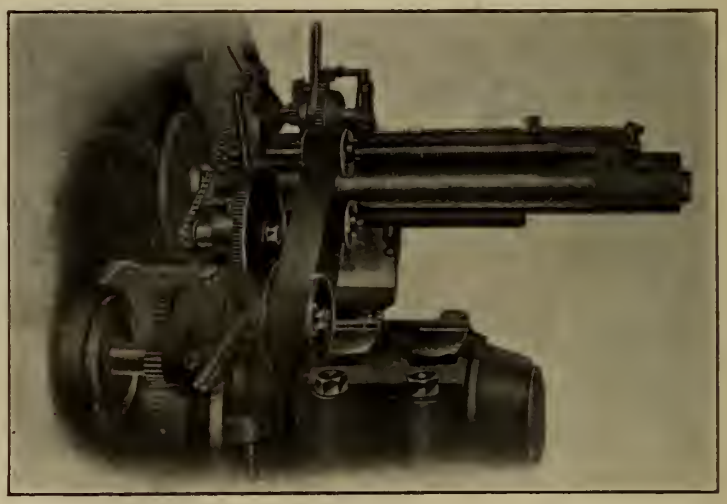


Fig. 2.—Commutator Grinder at Work.

These commutator grinders are being sold by Langdon-Davies Motors Canada, Ltd., 15 Alice Street, Toronto.

---

### NEW FRICTION CLUTCH AND CUT-OFF COUPLING.

In Fig. 1 is shown a half-tone of a new solid and split friction clutch and cut-off coupling, just placed on the market. Fig. 2 shows the clutch with the sleeve which is also used as a pulley. It also shows the clutch out of gear. Fig. 3 is the clutch in gear with a coupling hub attached. This is attached where the clutch is used as a cut-off coupling.

To put the clutch in gear, the sliding collar B, Fig. 2, is pushed in towards the driving hub C by a shifting lever attached to the thrust collar A. The shifting lever is not shown in this illustration. As this operation takes place it acts on levers K and J by pushing them in towards the driving hub C. This operates a toggle motion at the end of the lever J which draws up the slack on the drawbolts I against the spring M, thereby compressing parts F, D, E, D and C, together. The parts E and F, are feather-keyed to the driving hub C and the parts D, and D, are feather-keyed to the sleeve G or coupling hub O. This transmits the power from the driving hub C, which is keyed to the shaft; to the pulley on sleeve G.

If a cut-off coupling is used, the power is transmitted to the coupling hub O, which is keyed onto the other shaft as shown in Fig. 3.

The clutch has great power for size of clutch, due to large friction surface. The clutch is small in diameter and very compact for the power produced. This is important, especially where there is limited space.

The clutch cannot start when out of gear. When the clutch is out of gear and the power is out of gear, the belt running over the pulley which is keyed to the sleeve G, has a tendency to pull the belt one way or the other, but as the wood discs are only feather-keyed to the sleeve, they can move easily.

The sleeve may be fastened from giving one way by butting up against the driving hub C and prevented from going the other way by collar H, as shown in Fig. 2. This construction prevents any

danger of the parts being thrown together by the motion of the belt on the pulley, and starting the clutch unexpectedly.

The clutch is easily adjusted. Each

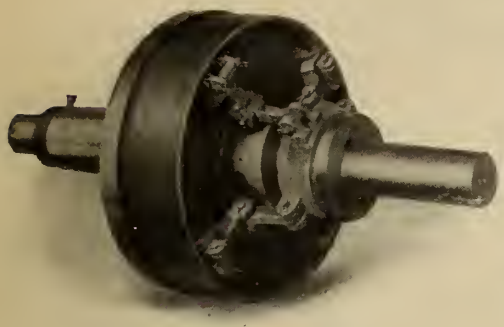


Fig. 1.—New Friction Clutch.

lever mechanism can be adjusted separately. To do this the nuts on the end of the draw bolts I are tightened or loosened as required with the ordinary wrench. The levers K J and L are all connected together by steel pins, with cotter split pins through the ends of the steel pins. This prevents any of the mechanism from working loose.

Levers and draw bolts are all made of steel. The levers of clutches are subject to severe stresses, and in having all steel levers, it reduces to a minimum any danger of breakage.

This clutch is so constructed that above the two smallest sizes it can be supplied either solid or split.

It is provided with a solid iron sleeve, and split babbitted sleeve interchangeable and removable without disturbing the mechanism. The solid iron sleeve is generally used with the solid clutch, and the split babbitted sleeve with the split clutch. However, they are made interchangeable, as sometimes a split sleeve may be used to advantage with a solid clutch. The reason of this is that sleeves

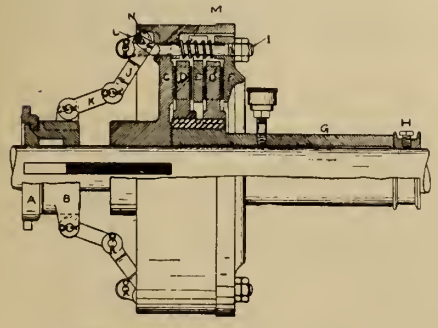


Fig. 2.—Friction Clutch.

as a rule get out of order a great deal quicker than the rest of the clutch and often require to be removed from the shaft to be repaired. In putting in machinery in the first place it is as easy to put a solid clutch on the shaft as a split one, and, therefore, the manufacturer by using a solid clutch and split sleeve would save the difference in price between the solid and split clutch, and also the trouble and time a solid sleeve may give him in getting it off the shaft.

By removing the nuts on the draw bolts I the driving plates and wood discs F, D, E and D can be moved out along the sleeve and cleaned off without removing any part of the clutch from the shaft. This is an important point with clutches using wood for friction surfaces, as the wood in time gets greasy which, if not cleaned, reduces the power of the clutch.

This clutch is manufactured by the Ideal Clutch Mfg. Co., 16 Pearl St., Toronto. The A. R. Williams Co., Toronto,

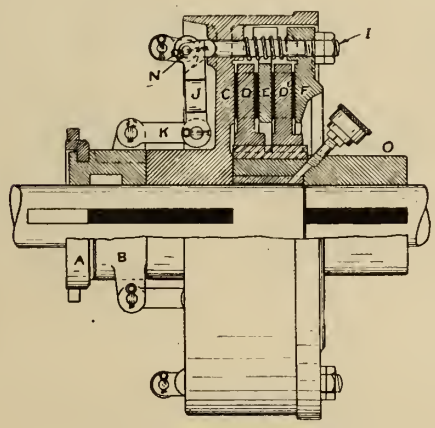


Fig. 3.—Friction Clutch.

and Williams & Wilson, Montreal, are selling agents.

---

## DOUBLE-SEATED VALVE.

The Crown Globe Valve has two separate points where steam is arrested. If in any way one of the bearing surfaces in either of the two points of stoppage becomes damaged, there remains a point of resistance.

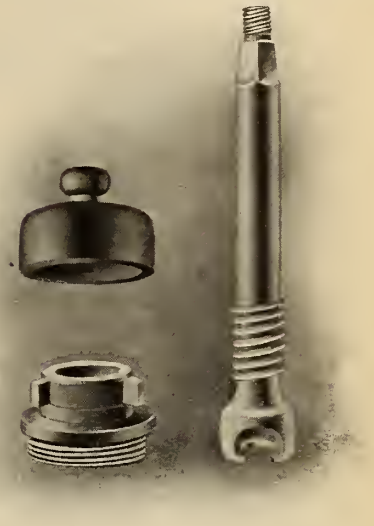
Fig. 1 represents a cross-section of the Crown Globe Valve partly open, showing the working parts in their relative positions. Fig. 2 represents the upper and lower seats and the valve stem.

The upper cup has two bearings or wearing surfaces, each ground to a true surface, and these two bearings correspond with other two bearings on the lower seat.

The three ribs on the outside of the lower seat guide the upper seat or cup, so that it cannot become displaced.

The water or steam in passing upward through the lower seat presses upward against the cup and then flows down all around. When the valve is being closed, guided by the ribs on the lower seat, comes down squarely on the lower, without friction.

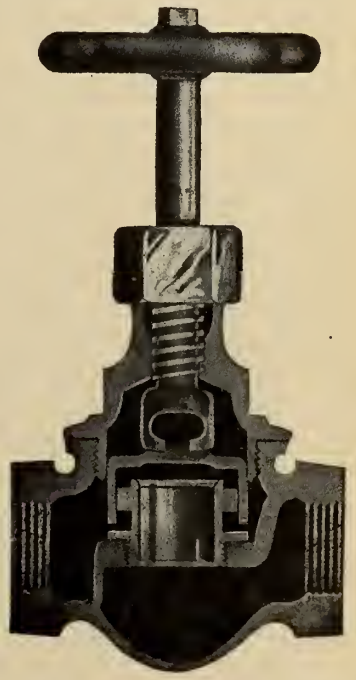
On the inside of the lower detachable seat will be found two small lugs. By



Seats and Valves.

inserting a wide screwdriver this seat can be removed when desired, and renewed. The stem is attached to the cup by means of a ball and socket, and can be detached without tools.

These cups are manufactured by Bar-



Two-Seated Valve.

key Bros., Brass Works, Stouffville, Ont.

---

One pound of fuel oil (19,000 B.t.u.) will evaporate 11 pounds or more of water.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., · Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg., Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

**UNITED STATES**
CHICAGO - J. Purkis Sharpe, 933-935 Monadnock Block
NEW YORK - 544 West 145th St., Phone Audubon 2430, R. B. Huestis

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C., Phone Central 12960, J. Meredith McKim

**FRANCE**
PARIS - Agence Havas, 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

**Vol. 1.** **NOVEMBER, 1908** **No. 3**

## PAYING THE PRICE.

In one of the large towns in Canada a new power plant instalation was made and our attention was drawn to the modern equipment. The engines were up-to-date in every respect, the generators were built according to the best present-day practice, and the switch board contained all the necessary equipment. The feed-water heater and condenser were efficient and everything appeared to be designed for the most economical running the plant.

In the boiler room it appeared the same, except that steam half filled it. The name-plate gave the name of a most reliable firm, and instalations of theirs have been made in many Canadian cities, giving every satisfaction. But this instalation was an exception. Investigation revealed the steam blowing out at numerous rivet holes and the engineer told of several visits being made by the boiler makers to repair the leaks.

It appeared at first to be due to carelessness of workmen in the boiler manufacturing plant, but this was not altogether the case. The owners of the power plant thought they could economize in the boilers. The result? Lost time and money making repairs. Buying a cheap boiler is pretty sure to involve the employment of low-priced, incompetent erecting men. In this case there were numerous delays making repairs until finally the matter was overcome by reaming out the bolt holes and putting in large rivets with the facilities that were at hand.

The maker, who produces a boiler according to the specifications of a buyer who wants "the cheapest," is in no way to blame if his boiler does not give complete satisfaction. For instance, to save cost by reducing the number of stays, he will keep just inside the limit allowed by law or the insurance companies. In this way he can produce a boiler which will pass inspection right enough, but it will depreciate much quicker than one with more stays, more time spent on production, and, consequently, a little higher in price. This is only one case in many that might be quoted as to the way cost is saved in production of boilers and other equipment and the maker cannot be blamed.

When a power plant owner allows himself to be tempted by cheap prices in boilers, engines and other equipment, be assured that he will pay the price that cheap goods mean. This is no reflection on the makers, the point which we wish to make being that it is not economy to instal the cheapest power equipment.

## THE MAN WHO KNOWS IS THE MAN WHO GROWS

Did you ever know a man, who, after years of hard work in a position at a small salary, suddenly started to rise until he occupied the position of chief engineer? He did not seem particularly clever, but a little investigation brings to light the reason of the man's advancement. When he was holding the job at small pay, he was reading and studying—preparing himself for something better.

He kept his eyes open and was always learning. He read the power papers and books, spent time each week absorbing information and working out problems that presented themselves in the power plant. By his reading he kept posted on all the new equipments and methods employed. The reading of these is far better than being told because it can be read over again and again until the methods are clearly understood. Time after time this man "knew how" and when someone was wanted higher up he got the position.

It is impossible for a man to excel if he spends all his spare time reading the scandals, etc., in the newspapers. We know of men who have been deprived of High School and University training, who have reached first place. The top was reached after hours of work and reading well-selected papers and books.

The question arises, How is one to know the books to purchase and read? A great deal rests on the selection of a book which covers the desired. First, have a talk with an engineer familiar with his work and the books relating to it. Then send to the publishers and get a synopsis of the volume. If the subject is governors, get a book on governors. There are books and books, and the cheap book with pages filled up with matter you do not want and perhaps cannot use, is not a cheap book in the ends. If you cannot decide with the help of a reliable engineer or the synopsis, write your technical paper. Books that do not suit your purpose are worthless. Read, but read books to prepare you for something better. If you have a well selected library you will be surprised at the progress you can make in a very short time.

## THE SOCIABLE ENGINEER.

In this issue of The Power House is an account of the 21st Annual Banquet of the Toronto Branch, Canadian Association Stationary Engineers, and it illustrates a point we wish to make; engineers should cultivate social ties.

The advantages of belonging to an engineers' association are not fully realized by some engineers. The mingling with men employed in a similar occupation to their own, the interchange of ideas, the addresses of prominent men in the profession, outings and banquets all have their elevating tendency. These will broaden his horizon and his view of life in general. He will learn not only to do his work more intelligently, but it will brighten his life and prepare him better for his day's work, to do it more cheerfully. Then with a faithful round of duties done he will enjoy the well-earned rest of body and peace of conscience.

The inspiration given by coming in contact with other engineers and prominent speakers is invaluable. It stimulates a man to do better work. Canada is full of opportunities for men with ability. By meeting other engineers in a social way he will aid in developing that ability. Cultivate sociability.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Transmission Line Equipment.

The engineers of the commission have adjusted the details of the construction of the transmission line with the contractors, the F. H. McGuigan Construction Co., and work will he commenced at an early date.

Tenders for the electrical equipment and apparatus required by the commission have been received and are being checked as to their technical details by the engineers of the commission. This is something that requires the utmost care and cannot, in fairness to the people, be rushed through in any haphazard fashion. Although the actual figures cannot be given at present it may be stated that they are considerably below the estimates made by the engineers of the commission for that portion of the work.

The tender of the Canadian General Electric Co., of Peterboro, and the Canadian Westinghouse Co., of Hamilton, all things considered, are the most favorable tenders received. As may be readily understood, the equipment and apparatus of these companies are not exactly alike, and in some respects the one excels that of the other and vice versa, and in order, by selection, to get the best results, it looks at present as though the amount, which is over one-half a million of dollars, should be apportioned between these two companies.

Chief Engineer Sothman has been to Pittsburg and other points in United States examining electrical equipments in use in power lines and his report will be considered by the commission.

It is understood that it will take the steel and iron manufacturers some eight weeks to make and deliver the materials, but a good start will be made with the work this fall.

## Steam Turbine Instalation.

The Dominion Iron & Steel Co., Ltd., Dominion Coal Co., Ltd., and Nova Scotia Steel & Coal Co., Ltd., are contemplating instaling steam turbine plants. The exhaust steam turbine is coming into use more and more every day, and is proving itself a necessity in large plants where economy is considered.

John Preston, mechanical engineer of the N. S. Steel & Coal Co., Ltd., at Sydney Mines, has been on a tour through the larger eastern cities of the United States, in order to see some of these plants in operation, and to determine if it would be advisable to instal a turbo-generator at Sydney Mines. He was very favorably impressed with the working of the plants which he visited in the States and says that it is just what they want at Sydney Mines, and it is expected that the management will at once proceed to instal this addition to their plant.

The Dominion Iron & Steel Co. and Dominion Coal Co. are not quite as far advanced in the project, and may, possibly, not do anything until their case is decided in the Privy Council. However, there is little doubt, but that they will also add turbo-generators to their plants in the spring.

## Trade Notes.

St. Catharines has decides to purchase a Waterous fire engine at a cost of $5,500.

George Haight & Sons are instaling woodworking machinery in their plant at Mount Albert.

The Kerr Engine Company, Ltd., of Walkerville, Ont., have just received an order for 100 of their gate hydrants for the City of Van-

## Electrical Development.

The Dufferin Light and Power Co., in which Toronto, Orangeville and Shelburne men are interested, has bought out C. W. Watson's electric lighting plant and system in Orangeville, James Pickering's plant in Shelburne, and the Huxtable water privileges at Horning's Mills. The company proposes to develop 800 or 1,000 horse-power at Horning's Mills and supply Orangeville, Shelburne, Grand Valley and Dundalk.

Mr. McKenzie, chief engineer of the Intercolonial Railway, has asked for tenders on the electrical equipment for the power house of the Prince Edward Island Railway at Charlottetown, which consists of a 75 k.w. direct-current generator, with potential of 230 volts, direct connected to and mounted on same base with engine. The specifications state that the generator must be under control, so that it will not show a variation as great as 2 per cent.

A proposition has been submitted to the Lethbridge, Alta., city council, with respect to the construction of an electric railway. The matter will be taken into consideration in connection with the proposition to pave the streets. A company had been organized and when the time was ripe would enter upon the construction of a radial line extending probably to Taber and Raymond. The work of paving the streets will not be taken in hand until 1909, and in the meantime the matter of the construction of a street railway, either by the company, or by the council as a municipal enterprise, will be investigated.

## Electrical Undertakings.

The telephone line between South Pender and ender Island has been completed.

The Hinton Electric Co., Vancouver, is instaling a $40,000 electric light plant at Kelowna, B.C.

Pincher Creek, Alta., has granted a franchise to the Pincher Creek Electric Light and Power Company.

Orillia's municipal power plant is now completed by the finishing of the new dam at Ragged Rapids.

Goderich has increased the capacity of its power plant by the addition of a new 500 h.p., 60-cycle machine.

The contract for constructing the Pipestone, Man., municipal telephone system has been secured by John Reid.

George Collison will receive a franchise and a bonus towards erecting a new electric light plant at Killarney, Man.

Strathcona city council will extend the electric power system to the Alberta Farmers' Association's grain-cleaning plant.

The contract for the construction of the Argyle municipal telephone system has been awarded to Playfair Bros., Baldur, Man.

The Northern Electric and Manufacturing Co., Montreal, has been awarded the contract for the fire alarm system for Dundas.

Nelson, B.C., is voting on a by-law to raise $85,000 for the addition of a second unit to the civic electric lighting and power plant.

The plant and franchise of the Yarmouth Telephone Co., at Yarmouth, N.S., have been sold to the Nova Scotia Telephone Co.

Glencoe, Ont., citizens, at a public meeting discussed electric light matters and pronounced in favor of establishing a municipal plant.

The rural telephone company at Delhi, Ont., is busy erecting poles on the streets, and expects to be ready for business in a short time.

The city council of St. Catharines has completed a contract with the Cataract Company for electric lights at $50 per arc light for five years.

The Ontario Power Co. is negotiating with the Westingbouse Co., of Pittsburg, for the purchase of a generator and switch board to cost $70,000.

The electric light station at Brockville, Ont., owned by the corporation of Brockville, was burned recently. Loss on buildings and machinery, $10,000.

The Lincoln Electric Light and Power Co. secured a contract from St. Catharines for light for a period of seven years, for $50 per arc lamp per year.

The City of Port Arthur has contracted with the Kaministiquia Power Co. for 400 h.p. at $25 per horse-power. The period of the contract is 10 years.

In connection with the Galt Electrical Manufacturing Company, the Lyons Electrical Company, of Brantford, is instaling a large generator at Burford.

Winnipeg city council has voted a further sum of $22,000 for the civic power scheme. The money will he expended on necessary work before the winter sets in.

Brantford is considering the question of municipal ownership of an electric plant or a contract with the Hydro-Electric Commission for both power and lighting.

Contracts have been made with the Hamilton Cataract Company for power for Oakville's system of electric lighting, and men are now at work instaling the new system.

The official opening of the St. Clair tunnel will be on Nov. 12, when the electric locomotives will draw trains through the tunnel and the power house will be inspected.

The private telephone line extending from Harrow, Ont., to points in the Township of Colchester, has been connected with the lines of the Bell Telephone Company at Harrow.

John Patterson has floated bonds in England for the construction of an electric road to include Hamilton, Waterloo and Guelph. It is expected that work will begin early next spring.

The Winnipeg Street Railway Company has made an offer to the city council to furnish that city with ten thousand horse power for ten years at $18.40 per horse-power per annum.

The Yellow Grass Electric Light and Power Co. has been formed under a municipal franchise for the purpose of erecting an electric lighting and power plant for Yellow Grass, Sask.

The authorities of Glace Bay, N.S., are instaling 400 meters in connection with the municipal electric light pllant, and are also adding about three miles of transmission lines to the system.

The Bell Telephone Company have recently completed a new line out the Eramosa road, from Guelph to Everton. This will give a more direct phone service from Guelph to Erin and Orangeville.

The Barrie Light Commissioners have decided to inaugurate a 24-hour electric light service as an extension of the present half-time system. In addition power will be sold for light, manufacturing and domestic uses in units up to five horse-power.

The City Electrical Supply Co. has been formed at Wetaskiwin, Alta., by N. D. Farris and R. C. Talbot, entering into partnership. The company will handle a full line of everything required in the electrical line.

The Winnipeg city council is considering the instalation of a patrol system. The system complete it is estimated will cost $250,000, but the present requirements will call for an expenditure of only about $60,000.

At a meeting held at Simcoe, Ont., to consider the telephone service, it was the concensus of opinion that the rural telephone line should he extended without delay. A telephone company was formed and directors appointed.

The Toronto Board of Control has accepted Alex Daw's terms as consulting engineer on the electric plant—$1,200 as retainer for the first year, in advance, $100 monthly thereafter, and $50 a day for time spent there.

Arrangements are now being made to put a by-law before the ratepayers of Fernie, B. C., to provide sufficient money to rebuild and operate the Crow's Nest Electric Light & Power Company's system as a municipal enterprise.

A company is being organized at south of Estevan, Sask., to construct a rural telepbone system with 11 miles of wires to be strung this fall and more added in the spring. Connection will be made with Estevan by a long-distance line.

Chatham, Ont., has finally accepted from the Colonial Engineering Co., of Montreal, the new gas producer engine for the city electric lighting plant, subject to the putting in of a new dynamo for the second-hand dynamo temporarily installed.

The Cataract Electric Light Co., is making considerable improvements to its plant at Shelburne, Ont. The tail race has been deepened, the dam repaired, and a new turbine water wheel put in position, which will materially increase the power developed.

The Kingston city light department is figuring upon the electric lighting of Portsmouth, and there is a possibility that arrangements will be made with the village council about ex-

tending the city system into the village, providing the service will pay.

Regina is considering the securing of cheaper power by the erection of a power house at the Dirt Hills, about sixty miles from the city, where there is said to be an abundant supply of excellent soft coal, and transmitting the power to the city by electric cables.

A telephone company has been formed in Cranbrook, B.C., to be known as the Kootenay Telephones, Limited, which will be capitalized at $200,000. They have purchased the Cranbrook Telephone Company's system and will operate within the boundaries of British Columbia.

The Granby Smelting Company will shortly install a new heating system at their powder thaw. Air will be heated by means of electric coils and blown by a fan into the thaw. If the new system operates satisfactorily a similar one will be installed at the Gold Drop mine.

Wynn-Meredith, the consulting hydraulic engineer, has completed a survey of the Jordan river, on Vancouver Island, for the B. C. Electric Railway, which company has made an appropriation of $1,500,000 to establish a power plant when a suitable location is fixed upon.

A Yukon gold dredging company has come into possession of a volume of water power at the head of Stewart river, which it is believed can be made to yield 83,700 horse-power. This company has a dredging concession from the Canadian Government on Stewart river covering 107 miles.

The Ontario Distributing Company is about to extend its lines in Stamford Township, Ont., to the marsh winery. It is supplying 100 h.p. to the Town of Niagara for lighting and for power at the waterworks, and is furnishing private lighting. The Queen's Royal has put in about 600 lights.

R. H. Parkinson, C.E., is engaged with a party of men on the north fork of Mission Creek, B.C., in surveying a storage area and selecting a reservoir site. It is understood the plans of the syndicate include the development of water power and the building of an electric tramway to Kelowna, B.C.

To meet the contract with the Hydro-Electric Commission the Ontario Power Co. has decided to add two units to its present plant of six units at Niagara Falls. The contract for the extension to the power house has been let to H. D. Symmes. The addition will add 25,000 horse-power to the capacity and will make a total of 95,000.

In connection with the improvement of Montreal harbor, plans are being prepared for the erection of an electrical plant for the distribution of the power required for every purpose along the harbor. An interesting feature is the fact that the power will be obtained from a source of supply near Montreal that has not yet been tapped.

The tender of the Canadian Westinghouse Co. was accepted for the lighting apparatus for the streets of Prince Albert. The outfit consists of fifty arc lamps, cut outs, regulating transformers, arresters and other supplies. The contract figure was $3,154.60. Fifty 12-foot mast arms will also be purchased from the Canadian General Electric Co. at $6.80.

A building permit has been issued at Victoria to the British Columbia Electric Co. which will add a storage and battery room to its present building on Store Street. The addition, which will cost $4,000, will be fitted up with the necessary appliances for storing electricity. At present there is considerable waste of power which, with the appliances to be installed, will be conserved.

The agreement with the Bell Telephone Co. for the renewal of the present exclusive franchise was submitted to the Chatham, Ont., city council recently. The company offer better phones, and agree to remove the poles and instal underground conduit wires on all the main streets. Independent phone lines will be free to establish local toll stations. The underground wiring work will, if carried out, mean the expenditure of $54,000 in the city.

The new transformer house of the Canadian Niagara Power Company is completed and the instalation of the three gigantic transformers has been made, increasing the output from 20,000 horse-power to 32,000 horse power. The new structure is an addition to the old transformer house and the machines that have been placed therein will be put in operation early in November with the new transmission line which has just been strung to Fort Erie, where it crosses to a point near Ferry Street, Buffalo.

A syndicate, composed of Toronto, Ottawa and Montreal interests, has been granted the privilege of developing the large water power at Raven Lake, which is some three miles south of Larder Lake. Surveys and plans are being prepared, and J. Samson Handley, of New Liskeard, has been retained as consulting engineer for the scheme. It is thought that several thousand horse-power can be generated from these falls, and the general outline of the scheme is to convert the power into electrical energy with a view of transmitting it to the various mines at Larder Lake on a high tension pole line.

Regarding the Robert contract, Mayor Payette, of Montreal, said: "I have every reason to believe that the by-law which the city council passed with the Robert Company for supplying electricity to the citizens is null and void." Mr. Robert said: "The terms of the agreement with the city in regard to a supply of electricity were such as to make it impossible for us to accept it. The mayor's declaration that the contract is null and void affects us little, as we would not sign the contract as it stood." It now means that the Montreal Light, Heat & Power Company have an absolute monopoly.

## New Hamilton Waterworks Equipment.

The fire and water committee, Hamilton, has awarded the contracts for pumps and motors to be operated by Cataract power for the new waterworks. The John McDougall Caledonia Iron Works, Montreal, will furnish the pumps at a cost of $7,220. The Canadian Westinghouse Co., Hamilton, will supply the motors for $12,928, and J. Montgomery, Toronto, the air pressure system of pumping water to mountain residents at a cost of $6,500.

## Peat and Lignite in Canada.

The Canadian Department of Mines has published a volume on "The Manufacture and Use in Europe of Peat and Lignite," prepared by E. Nystrom, M.E. The investigation was undertaken because of the large areas of peat bogs in Canada, the estimated amount being 37,000 square miles. Of this, 25,000 square miles are located in Alberta, Saskatchewan and Territories. The average depth of the deposits is from 5 to 10 feet. The Moose River basin of Ontario has 10,000 square miles of such deposits, while the other areas are scattered through different provinces, of which many average 8 to 10 feet deep. The coal deposits in Canada are situated in the east and westerly provinces, leaving the interior provinces practically dependent on the coal mines of the United States, the disadvantage of which was strongly felt a few years ago, when, on account of the strike at those mines, the available coal supply was seriously curtailed and enormous prices had to be paid. The manufacturing into briquets of peat and lignite in Canada, it is figured, would largely curtail the importations of coal, which amount to about $20,000,000 a year.

## Large Power Development Scheme.

A gigantic corporation, headed by Minneapolis men, with a capital stock of $7,000,000, has been organized to undertake several large schemes at Fort Frances, Ont., develop idle water power into practically an unlimited supply of electricity, produce one of the greatest paper-making centres in the world, and conduct lumbering operations over a territory containing 15,000,000 square miles. The organization is known as the Minneapolis and Ontario Power Company. The contract has been let to the engineering and contracting firm of J. G. White & Co., New York, who will complete the immense dam and hydro-electric power stations at International Falls and Fort Frances, and the building of ground wood, sulphite and newspaper plants.

## CATALOGUES.

DILL DRIVE—Pamphlet from T. C. Dill Machine Co., Philadelphia, Pa., describing the Dill system of driver.

VERTICAL BORING AND TURNING MILLS—Leaflet describing 50-in., 60-in., 64-in. and 72-in. sizes, from Gisholt Machine Co., Madison, Wis.

PUMPING ENGINES—Bulletin 1611 from Allis-Chalmers-Bullock, Montreal, describing the complete equipment of the Chicago Sewerage Pumping Station.

DRILLS—Catalogue and price list No. 4 of high speed drills, made from flat bar stock from Hackett High Speed Drill Co., 90 West Street, New York City.

BOILER TROUBLES—The Bird-Archer Company, 90 West Street, New York. Pamphlet boiler troubles and their prevention. Illustrated, 48 pages, 6x9 inches.

D. C. MOTOR—Circular 1138 from Canadian Westinghouse, Hamilton, describing and illustrating the construction and application of their A. C. motors.

CALENDAR—From Stephenson Mfg. Co., Albany, N.Y. This company is issuing a very popular series of pretty girl calendars, one of which will be mailed monthly, on request.

SMOOTH-ON—From Smooth-On Mfg. Co., Jersey City, N.J., instruction book No. 7, describing the different Smooth-On specialties and a number of new ones, Smooth-On Iron Cement, Tape, Packing, etc.

COPPER FLOATS—Catalogue and price list of Hercules seamless copper floats, air chambers for steam pumps, and carburetter floats from Hercules Float Works, 202-204 Franklin St., Springfield, Mass.

SEPARATOR AND SUPERHEATER—From Ideal Steam Separator & Supply Co., 73 Adelaide St. E., Toronto, describing and showing the method of instaling Potter separators and superheaters.

REACTIONS—Published quarterly by the Thermit Co., New York, and issued in Canada from their Canadian office, 103 Richmond St. W., Toronto. It gives many examples of the recent use of Thermit for welding. The feature of this number is Thermit welding of locomotive frames.

POWER TRANSMISSION MACHINERY — 269-page catalogue, B7, from Dodge Mfg. Co., Toronto. The lines of power transmission, elevating and conveying machinery are illustrated and described. Under power transmission, gears, right-angle drive, pulleys, hangers, etc., are described and much useful information is given, making the volume valuable to superintendent and purchasing agent.

AIR COMPRESSORS—The Canadian Rand Co., Montreal, have issued a finely gotten up catalogue of steam and power-driven air compressors of Rand design. By many illustrations and descriptions, the efficiency, economy and length of service of these compressors are pointed out, and details given of construction, which characterize the products of the company as distinctly Rand. It is apparent from this that the catalogue will be of great assistance to the purchaser and to the man in charge of the machine.

## BOOK REVIEW.

HYDRO-ELECTRIC DEVELOPMENTS.—By Preston Player. McGraw Publishing Co., New York. Cloth; 68 pages, 4½x7½ inches; illustrated; indexed. Price, $1.

This little work deals particularly with the commercial side of hydro-electric enterprises. It sets forth the information which should be obtained in order to afford a definite basis for forming a decision as to the merits of any particular water-power scheme.

There are nine chapters, dealing with: Preliminary Determinations; Methods of Procedure; Cost of Energy Manufacture; Central Station Economics; Capital Costs, etc.

VALVE GEARS AND INDICATORS—By Walter S. Leland and Carl S. Dow. 150pp., 105 illustrations. Price, $1.

Two books in one. Contains useful information regarding the layout and design of valves and valve gears. The second part, pertaining to indicators, gives description of the various makes in use, then follows with a clear, simple explanation of their operation and the reading of the indicator cards.


# Condensed Advertising

### RATES

One insertion—25c. for 20 words; 1c a word for each additional word.

Yearly rate—$2.50 for twenty words or less; 10c a word for each additional word.

### TO INVESTORS.

ONE OF THE PROGRESSIVE Western Contracting Companies last year paid 40 cash from its manufacturing profits. The company is now extending to meet the heavy demand on the coast and now offers a small block of its stock at par. For full particulars write Box 1, POWER HOUSE, Toronto.

### DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Machine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. The "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

# Less Friction, No Waste, 50% Greater Economy

**These are the infallible results of using any good cup grease in combination with the**

# "PHILADELPHIA" GREASE CUP

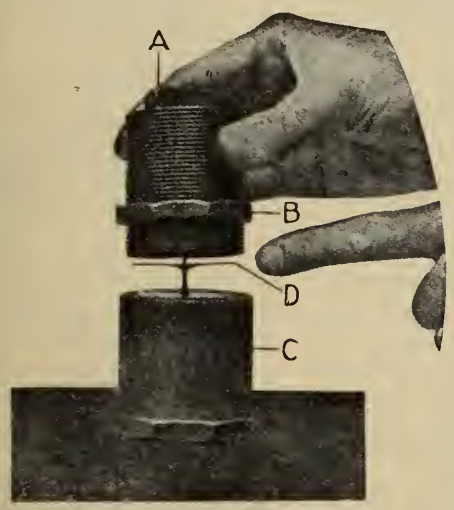



FIG. 1.
Method of filling: Screw the cup into place before filling; unscrew and remove A; fill C even full with grease, holding A as shown in cut (with locknut B and disc D in position shown) screw it into C to the position illustrated in Fig. 2 or not to exceed one-quarter its length.

¶ It is a thoroughly demonstrated fact that in most cases where liquid oil is used as a lubricant there is more waste than lubrication. Grease, or rather "solidified oil," is a much more efficient lubricant, if you can apply it properly. The Philadelphia Grease Cup overcomes every difficulty in applying grease to the journals by means of a compressed air feed. It keeps a constant film of grease between the frictional points — practically eliminating the friction. The solid character of the grease does away with all possibility of waste, and the perfect lubrication thus afforded enables you to get the best possible work out of your machines.

FIG. 2.
Shows cup filled with grease, the upper part screwed into place. This will suffice for a run of from one week to a month, according to the nature of the journal. In the bottom of the cup is a funnel which draws the grease to the centre so that if the grease runs low and the cup cannot be at once refilled, the surplus in the funnel will be sufficient to lubricate the journal until the refilling is done.

## ALL PRACTICAL ENGINEERS

are interested in this cup. The assertions we make are fully backed up by indisputable proof. We don't expect you to take us on trust. We want to SHOW you. We expect all practical engineers who see this advertisement to write us a postal asking for full particulars, whether they are in a position to instal our cups or not. This cup is a good thing for engineers and manufacturers alike, and we want them all to know it.

*WRITE FOR PARTICULARS TO-DAY.*

## The Peterborough Lubricator Mfg. Co. Limited

**Peterborough, Ontario, Canada**

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

### Air Chambers.
Hercules Float Works, Springfield, Mass.

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Dressings.
Stephenson Mfg. Co., Albany, N.Y.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
Canadian Fairbanks Co., Montreal.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

### Boiler Cleaner.
Canada Chemical Mfg. Co., London.

### Boiler Feed Regulators.
Standard Engineering Co., Toronto.

### Boiler Mountings.
Standard Engineering Co., Toronto.

### Boilers.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Castings, Brass.
Hercules Float Works, Springfield, Mass.

### Condensers.
Goldie & McCulloch Co., Galt.
Laurie & Laub, Montreal.

### Coppersmiths.
Hercules Float Works, Springfield, Mass

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Driving Rope—Cotton.
Jones & Glassco, Montreal.

### Dynamos.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Automatic.
H. W. Petrie, Toronto.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

### Engines, Gas and Gasoline.
Colonial Engineering Co., Montreal.
Gas & Electric Power Co., Toronto.
J. DeClercy, C.E., Montreal.
Jones & Glassco, Montreal.

### Engines, High Speed, Steam.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Simple and Compound.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Vertical.
H. W. Petrie, Toronto.

### Exhaust Heads.
Standard Engineering Co., Toronto.

### Feed Water Heaters and Valves.
Darling Bros., Montreal.

### Floats, Seamless, Copper.
Hercules Float Works, Springfield, Mass.

### Gas Producer Plants.
Colonial Engineering Co., Montreal.
Gas & Electric Power Co., Toronto.

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Grease Cups.
Peterboro Lubricator Mfg. Co., Peterboro

### Hangers.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Heaters.
Goldie & McCulloch Co., Galt.

### Heating and Ventilating Apparatus.
Sheldons Limited, Galt.

### Indicators, Steam Engine.
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Mill Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Motors.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Pipe Threading Tools.
Borden-Canadian Co., Toronto.

### Planimeters.
Jas. L. Robertson & Sons, New York.

### Plate Work.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Power Transmission Machinery.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Pump Governors.
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Reducing Wheels.
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt.

### Shafting.
Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Union Drawn Steel Co., Hamilton.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Steam and Oil Separators.
Standard Engineering Co., Toronto.

### Steam Pumps.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Steam Specialties.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.
Sheldons Limited, Galt.
Standard Engineering Co., Toronto.

### Steam Traps.
Sheldons Limited, Galt.

### Stocks and Dies.
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Switchboards, Light and Power.
Gas & Electric Power Co., Toronto.
Hill Electric Mfg. Co., Montreal.

### Switchboard Supplies.
Hill Electric Mfg. Co., Montreal.

### Switches, Electric.
Hill Electric Mfg. Co., Montreal

### Tanks, Oil.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford

### Turbine Water Wheels.
Canadian Fairbanks Co., Montreal
Jenckes Machine Co., Sherbrooke, Que
Jas. Morrison Brass Mfg. Co., Toronto.
J. C. Wilson & Co., Glenora, Ont

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Venetian Grates.
J. De Clercy, Montreal.

### Watt Meters.
Gas & Electric Power Co., Toronto.

### Wood Split Pulleys.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.

## ALPHABETICAL INDEX TO ADVERTISERS


**A**

American Industrial Pub. Co. ..... 43
American School of Correspondence ..... 43
Audel & Co., Theo. ..... 5

**B**

Borden-Canadian Co. ..... 7

**C**

Canada Chemical Mfg. Co. ..... 5
Canada Machinery Agency ..... 3
Canada Metal Co ..... 45
Colonial Engineering Co., Montreal ..... inside front cover

**D**

De Clercy, Jules, C.E. ..... 46

**E**

Electrical Maintenance & Repair Co. ..... inside back cover

**G**

Garde, John, & Co ..... 46
Gas & Electric Power Co. ..... 2
Goldie & McCulloch Co. ..... 8

**H**

Hercules Float Works ..... 46

**J**

Jenckes Machine Co. ..... 3

**K**

Kilmer & Pullen ..... inside back cover

**M**

Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

**Mc**

McLaren, D. K., Ltd ..... 4

**P**

Packard Electric Co., Ltd. ..... 48
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 6
Peterboro Lubricator & Mfg Co ..... 41

**R**

Robertson, Jas. L., & Sons ..... 43

**S**

Sadler & Haworth ..... 43
Sheldons Limited ..... 5
Sight Feed Oil Pump Co ..... 3
Stephenson Mfg. Co ..... 46
Schuchardt & Schutte ..... 46

**T**

Toronto Plate Glass Importing Co ..... 46

**W**

Waterous Engine Works Co ..... 1
Wilson, J. C., & Co ..... 48

SET OF HAND BOOKS ON

## MARINE ENGINEERING

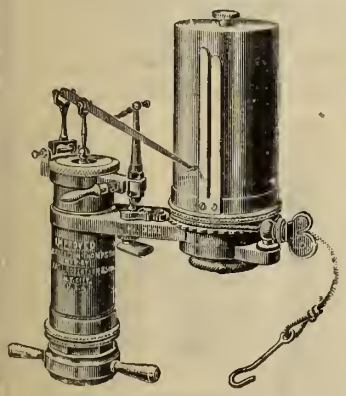
The following books have been carefully selected from among the large number of valuable publications on Marine Engines and we can recommend them as an excellent set for Engineers, Firemen and Mechanics. They should be in the hands of every Marine Engineer, whether he is experienced or just starting in the business. Study books in the order named.

| | |
|---|---|
| Catechism of the Marine Steam Engine | $2.00 |
| American Marine Engineer | 2.50 |
| Modern Examinations of Steam Engineers | 2.00 |
| The Steam Engine Indicator and Its Appliances | 2.00 |
| Questions and Answers for Marine Engineers | 2 00 |
| | $10.50 |

Any one of the above books sent by mail, on receipt of price, or the *complete set* for $9.00. Send for Catalogue.

**THE AMERICAN INDUSTRIAL PUBLISHING CO.**

Box M. Bridgeport, Conn., U.S.A.



## POWER PROFIT is MONEY EARNED

Every Engine will do more work without extra cost when trued up with a

**ROBERTSON-THOMPSON INDICATOR**

Up-to-date in construction —sold at a moderate price and on easy terms if desired.

**Jas. L. Robertson & Sons**
38 Warren St., New York

## SADLER & HAWORTH

### Oak Leather Belting

## WHEN A LEATHER BELT

*Is not satisfactory it is a costly nuisance. You cannot afford to make mistakes. You run no risk when you buy*

## "CLIMAX"

## The Platform of Success

### KNOWLEDGE IS THE PLATFORM OF SUCCESS

A good, strong, educational platform is as essential to the business man, professional man or trade worker who aspires to success as the political platform is to the presidential candidate. The new **SIX VOLUME** edition of the

### CYCLOPEDIA OF Applied Electricity

offers the electrical worker a platform on which he can make a successful stand. It contains 3,000 pages, 7x10 inches; numerous illustrations, diagrams, tables and formulas, handsomely bound in half red Morocco and carefully indexed for ready reference.

Every known electrical appliance is given special attention, every subject treated by an expert—written plainly and clearly. This wonderful Cyclopedia is authoritative, comprehensive, will give you the opportunity you desire, no matter if you are working at the bench or an experienced electrician.

The whole work is profusely illustrated with special drawings, diagrams, photographs, tables and formulas, supplemented with a series of practical test questions with solutions carefully indexed for ready reference. To introduce our Home Study Courses from which the Cyclopedia was compiled, we make this special

## FREE 5-DAY OFFER

Just fill in the coupon and we will send a set of these beautiful books absolutely FREE for 5 days' examination. If you find the books satisfactory, pay $2.00 within 5 days and $2.00 a month until you have paid the special $18.60 price; otherwise notify us to send for them at our expense.

SPECIAL PRICE $18 60 REGULAR PRICE $36.00

Order promptly and we will include FREE for one year, as a monthly supplement, the

### TECHNICAL WORLD MAGAZINE,

a live, up-to-the-minute, $1.50 monthly, crowded with special technical articles written in popular form and illustrated with scores of interesting photographs.

BRIEF LIST OF CONTENTS

Theory, Calculation, Design and Construction of Generators and Motors; Types of Dynamos and Motors; Elevators; Direct-Current Motors; Electrical Measurements; Electric Lighting, including Arc and Incandescent Lighting, Nernst Lamp, Cooper-Hewitt Lamp, Osmium Lamp, etc.; Electric Railways, including Third-Rail System, Multiple-Unit Control, Electro-Pneumatic Control; Alternating-Current Motors, etc.; Single-Phase Electric Railway; Electric Welding; Mercury Vapor Converter; Management of Dynamos and Motors, including the Location and Remedy of Troubles, such as Sparking at the Commutator, Heating, etc.; Power Stations; Central Station Engineering; Central Station Design; Storage Batteries, including Charging and Discharging, Troubles and their Remedies, Tests for Impurities, etc.; Power Transmission, Alternating-Current Generator, Synchronous Motor, Induction Motor, Transformer, Rotary Converter, Frequency Changer, etc; Electric Wiring, Electric Telegraph; Wireless Telegraphy; the Telautograph; Telephony, including Instruments, Lines, Exchanges, Common Battery Systems, Operation, Maintenance; Automatic Telephone; Wireless Telephony; Telegraphone, etc.

**AMERICAN SCHOOL OF CORRESPONDENCE**
CHICAGO, U.S.A.

### FREE OFFER COUPON

*Fill in, clip and mail to-day.*

American School of Correspondence:

Please send Cyclopedia of Applied Electricity for 5 days' FREE examination. Also Technical World for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60; otherwise I will notify you and hold the book subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

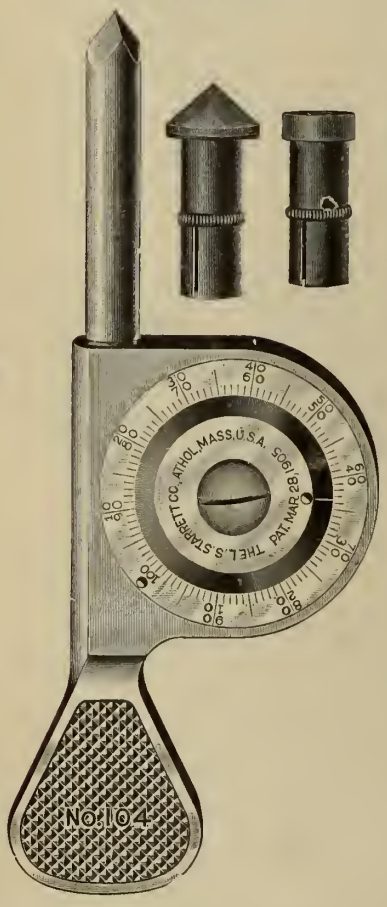
POWER HOUSE—11—08

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

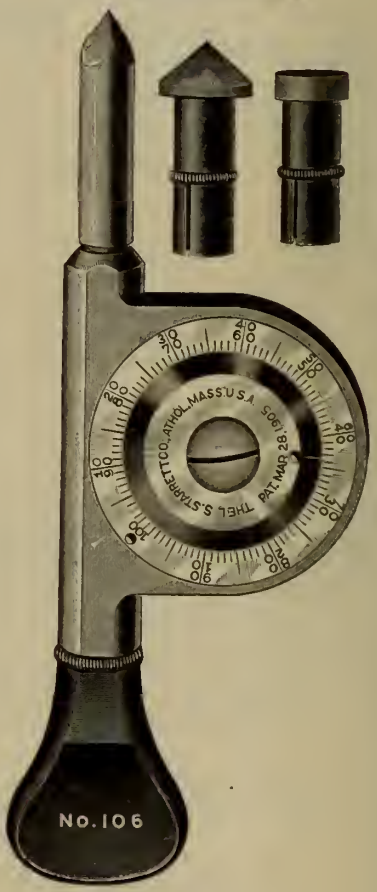
To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**



**STARRETT REGISTERING SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

**Start in TO-DAY to earn one of these Handy Tools.**

## THE POWER HOUSE, 10 Front Street East, Toronto

# OUR METALS

## have a reputation, especially our

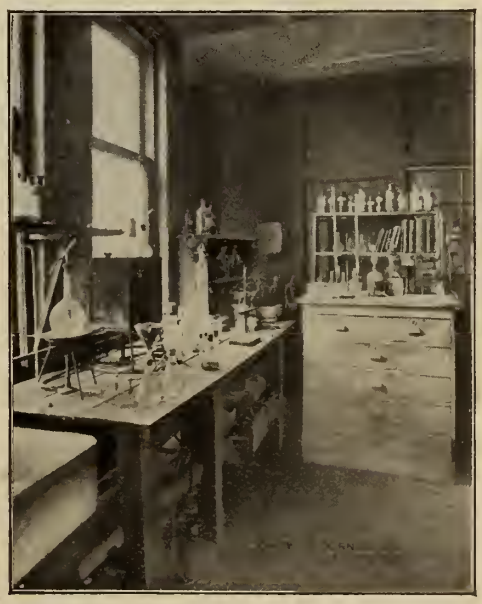
# IMPERIAL GENUINE BABBITT METAL

which is alloyed for heavy duty engine work, crushers of immense weight, crank pins and where hard work is required.

## WE OPERATE

our own Chemical Laboratory, (corner of same we show herewith) where we test for purity all raw materials entering in our various bearing metals and ELIMINATING ALL GUESS WORK, enabling us at all times to produce our uniform high quality metals.

**Write for "All about Babbitt."**



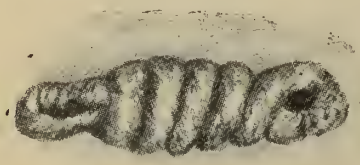
## The CANADA METAL CO., Limited

**31 William Street** **TORONTO**

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

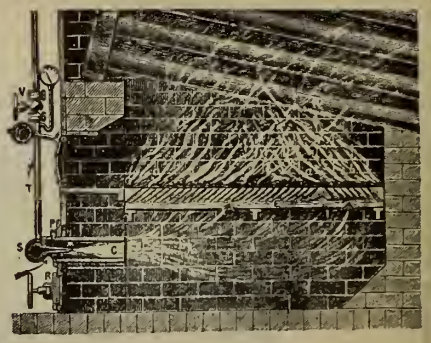
THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

# FLOATS

Not "just ordinary floats," but **Hercules Seamless Copper Floats**, the best floats made. Over 240,000 in daily use. If it's floats—get Hercules and *know you're safe from trouble.*

Write for Catalog "C"

**Hercules Float Works**
P.O. Box 396. Springfield, Mass.



# Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

Saves 20% to 50% in your fuel bills.

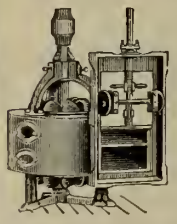
*For Particulars Apply*

**J. de Clercy, C.E.**
**62 Ontario St., West**
MONTREAL

## OPAL GLASS TILING

FOR WALLS OF
**MACHINERY AND POWER HOUSES**
Most approved material.
**TORONTO PLATE GLASS IMPORTING CO'Y.**
PLATE AND WINDOW GLASS
135 to 143 Victoria St., - Toronto

## Improved "LITTLE GIANT" TURBINE WATER WHEEL



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effieiency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

Write for descriptive catalog.

**J. C. Wilson & Co.**
**GLENORA, ONT.**
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.

## GET A BOX AND TRY IT

Find out for yourself why so many of your friends use STEPHENSON Dressings. Two kinds you know—RED Label Brand for Leather Belts only, and GREEN Label for Rubber and Canvas Belts.

And be sure you get the kind that has The Man with the Cog-Wheel Face on each Pound Stick. No other is Genuine STEPHENSON Dressing.

**Price 40 cents per lb. for a 12-lb. box.**

Of Dealers everywhere, or

**Stephenson Manufacturing Co.**
ALBANY, N. Y.

# HAND TACHOMETERS

No watch required for readings.

½ full size.

Registers from 30 to 4,000 revolutions per minute **without using a watch.**

**Schuchardt & Schutte**
**91 Youville Square, MONTREAL**
New York, London, Shanghai, Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen, Budapest

The

# Steam Engine Indicator and Its Appliances

By WILLIAM HOUGHTALING

THIS is a practical book by a practical engineer who has gathered his data during a professional career of over a third of a century. It is written in plain, every-day-English, as free as possible from complicated technical terms. It is illustrated with 150 engravings, 20 full page tables, and is handsomely bound in silk cloth. Just look over the table of contents and decide whether this book contains any information useful to you in your daily business of Engine Operating! : : : : : : : :

CONTENTS

Chapter I. Brief History of Indicator. II. Purpose of the Indicator. III. Definition of Technical Terms. IV. Construction of the Steam Engine Indicator. V. Indicator Appliances. VI. Indicator Appliances Continued. VII. Indicator Reducing Motion. VIII. Drum Stop and Electrical Attachment. IX. Care and Use of Indicator. X. To Take Diagrams XI. In ic tor Diagrams. XII. Study of Diagrams. XIII. Lines and Points of the Diagrams. XIV. Isotherm al Curve. XV. Adiabatic Curve and Point of Cut-off. XVI. The Foot, Pound and Measurement of Diagram. XVII. Expansion of Steam. XVIII Hyperbolic Logarithms. XIX Theory of Action of Steam Expansion in Cylinders. XX. Reading the Diagrams. XXI. Different Methods of Computing Water Consumption. XXII Indicator Testing Device. XXIII. Planimeters. XXIV. Comparison Diagrams from Throttling and Cut-off Engines. XXV. The Economy of Expansion. XXVI. The Point of Cut-off. XXVII. Back Pressure and Compression. XXVIII. Combining the Diagrams from Compound Engines. XXIX Diagrams from Gas and Oil Engines and Ammonia Compressors. XXX. Making Calorimeter Tests. XXXI. Miscellaneous Diagrams. XXXII. Engine Economy.

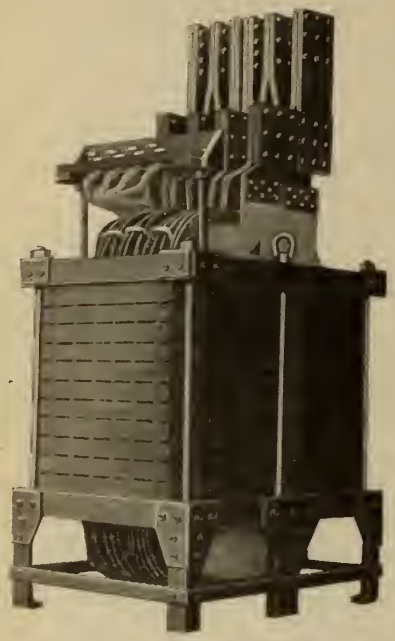
## To all Subscribers sending in Two Paid-up Subscriptions to The Power House we will send a copy of this Book free. :: :: :: ::

We are selling a large number of The Steam Engine Indicator and Its Appliances at ***TWO DOLLARS*** per copy, and readers tell us it is really excellent value for the money. Why not get a couple of subscriptions for The Power House from among your fellow engineers and secure a copy of this book free.

# THE POWER HOUSE

10 Front Street East - Toronto

Published once a month. $1.00 a year. 10 cents per single copy



750 K.W., 25 Cycle
1,200 Volt Transformer

**Packard Transformers are recognized as the standard of reliability for all classes of Power service.**

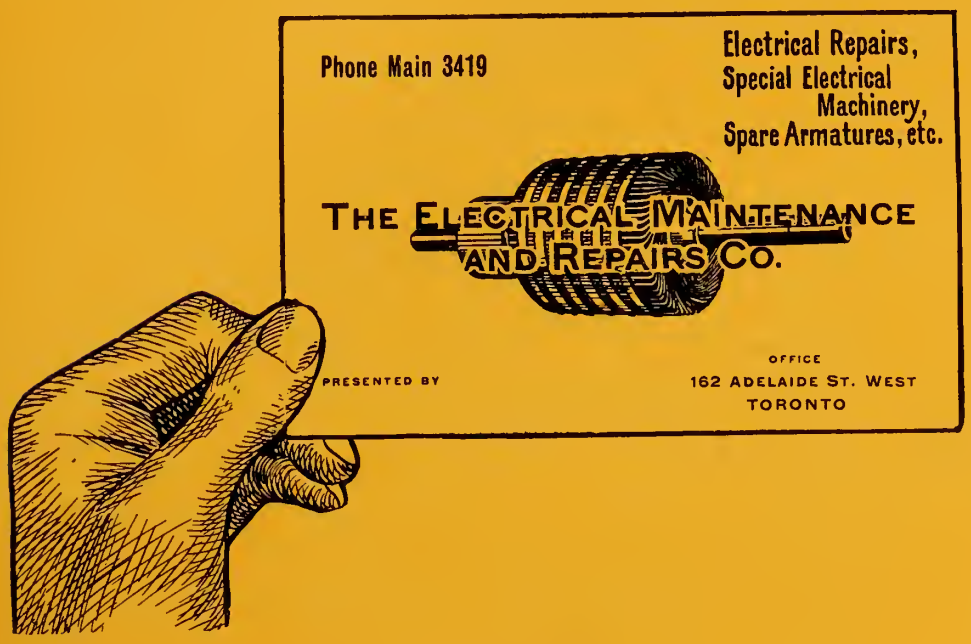
# The Packard Electric Co., Limited

Head Office and Works, - St. Catharines, Ont.
Western Office, - Somerset Bldg., Winnipeg
Eastern Office, - - Bell Telephone Bldg., Montreal

**Type D. Induction Motors are built for severe service, strong and rugged in construction, great overload capacity, high efficiency and low temperature rise.**

20 H.P. Induction Motor. Type D.

# Good Morning, What can we do for you to-day?




# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

## KILMER & PULLEN,

505 McKinnon Building,
TORONTO

# Engineers' Supplies

and

## Steam Specialties

Every engineer knows that it is economy to use good valves.

J. M. T. Steam-Metal Valves are well known throughout the Dominion as containing all that is best in valve construction.

Furnished with composition disc or high pressure copper disc.

Made in Standard and Extra Heavy Patterns.

## THE IMPROVED J. M. T. INJECTOR

All Good Injectors

Should be simple in construction.

Should be made of highest grade material.

All parts should be interchangeable and machined accurate to proper dimensions.

Our IMPROVED J.M.T. INJECTOR embodies these features, in addition to other improvements in construction.

The Improved J.M.T. Injector operates at a pressure as high as 220 lbs.

The pressure limit of the ordinary injector is 160 lbs.

Ask your dealer for the Improved J.M.T. Injector.
They cost no more than others.

Our reputation for "**Full Weight**" Engineers' Brass and Iron Goods has been established for the past twenty-five years. **Quality** the best to insure efficiency and durability.

**THE**

## JAMES MORRISON BRASS MFG. CO.

**Limited**

**93-97 Adelaide Street West** **TORONTO**

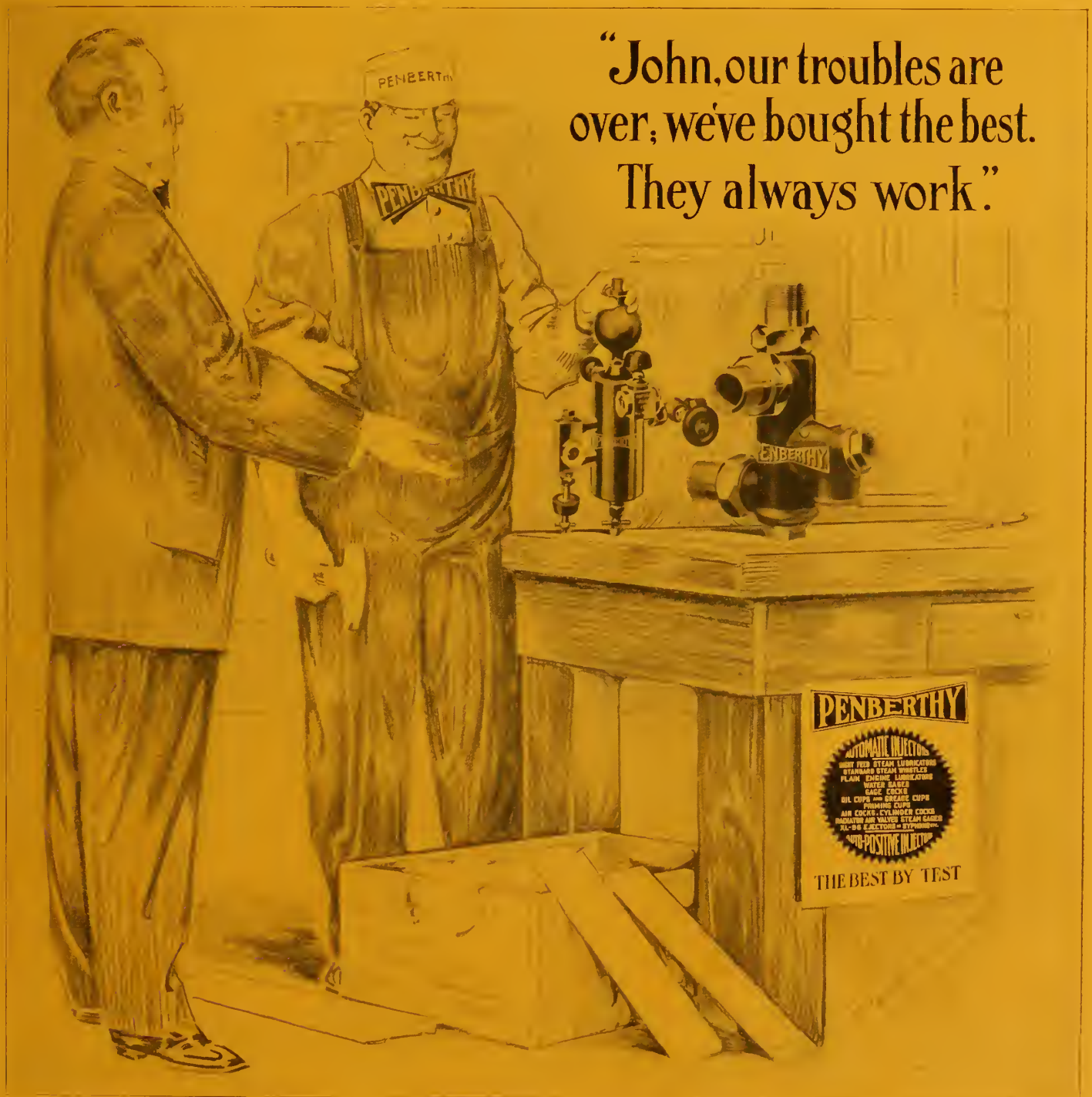
CIRCULATES IN EVERY PROVINCE OF CANADA.

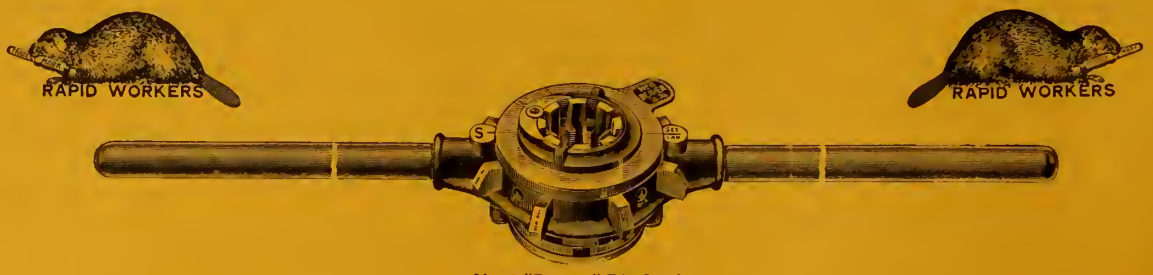
# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. I. Publication Office, Toronto — December, 1908 No. 4






No. 6 "Beaver" Die Stock

Let us send you a "Beaver" Die Stock on

# Ten Days' Free Trial

and if it is not every bit as superior to ordinary Die Stocks as we claim it is, we will take it back without charging you a cent.

## *Threads four sizes of pipe without changing dies*

¶ Just figure out what a lot of time you can save with a "Beaver" when you have any pipe-threading to do.

¶ Instead of hunting out a different set of dies for each size of pipe, you can adjust your "Beaver" to any of the four sizes within its range in a "jiffy."

¶ The threads cut by a Beaver are always absolutely accurate and properly tapered.

¶ No danger of stripping threads when you are using a "Beaver" because the cutting dies are always in perfect alignment.

Number 6 "Beaver" cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by a single cam, so constructed as to move one set of dies out of the way while the other set is in use.
Number 2 "Beaver" cuts 1-in., 1¼ in., 1½-in., 2-in. pipe. One boy can successfully operate this tool.
Number 4 "Beaver" cuts 2½-in., 3-in., 3½-in., 4-in. pipe and a boy can operate it with a ratchet handle.

## Don't Delay—Write NOW

# Borden-Canadian Company

**66 Richmond Street East, Toronto, Ont.**

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units

**Specially Suited for Direct Connected Electrical Works.**

Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

**BRANTFORD, - ONTARIO**

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

"NULLI SECUNDUS"

J STOKER NES

JONES UNDER-FEED STOKER CO. LIMITED MONTREAL, TORONTO.

The Jones Stoker produces complete combustion in the furnace, eliminates smoke and produces the greatest possible amount of steam per pound of coal.

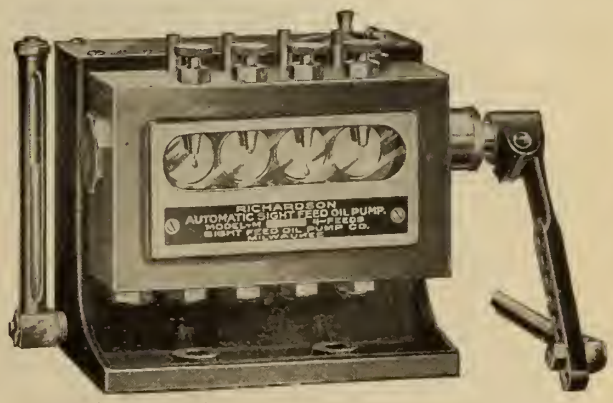
## Jones Underfeed Stoker Co.

Limited

National Trust Building, TORONTO.

Coristine Building, MONTREAL.

# The Model "M" Method




You know that the most economical and perfect lubrication is secured by an automatic oil pump that positively delivers small quantities of oil to the steam at very frequent intervals.

Tool steel polished plungers, hardened check valves, adjustable metallic packing, and other refinements of construction are a part of the interesting details of Model "M."

The Model "M" Method ! Do you know about it ? Told in Bulletin No. 109-L.

**Manufactured by**

## SIGHT FEED OIL PUMP CO.

**Milwaukee, Wis., U.S.A.**

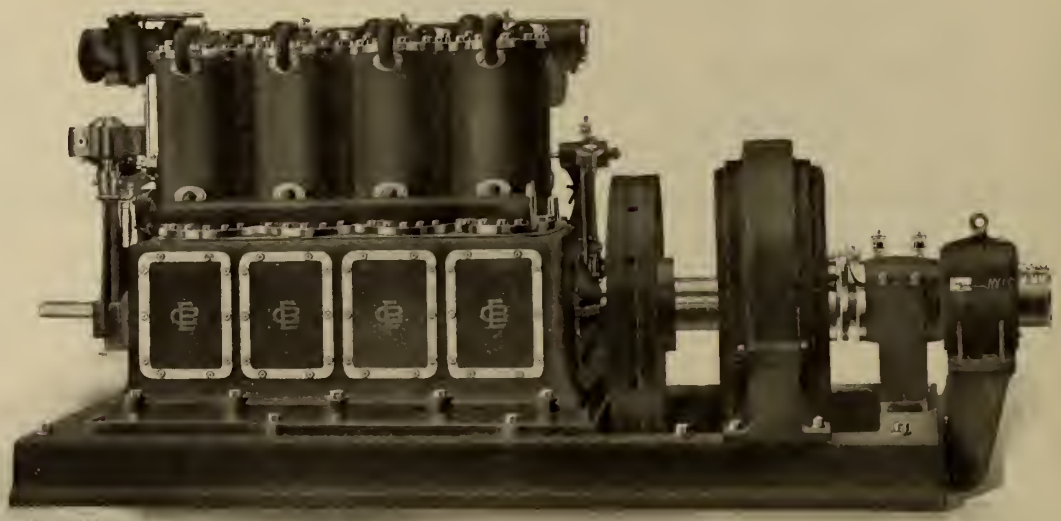
# The Gas and Electric Power Co.

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants
## Pressure Gas Plants

10 to 1,500 B. H. P.

Great Economy in Working.
Extreme Simplicity.
Plant occupying the smallest amount of space.

Little or no Cost in Repairs.
No Gas Holder. No Boiler.
No Chimney. No Smoke. No Soot.
No Smell. No Danger.



Ready for use in 20 minutes. Low Initial Expense.
Saving 50 to 80 per cent. over steam.
Engine direct connected to Alternators.
Guaranteed to run in parallel successfully.

## Complete Plants Equipped and Erected.

PRICES AND PARTICULARS FROM

# The Gas and Electric Power Co.

STAIR BUILDING, BAY STREET
TORONTO

# HORIZONTAL TUBULAR BOILERS

## FOR MEDIUM OR HIGH PRESSURE

We build them in all sizes from 10 h.p. up to 250 h.p. and larger.

High pressure tubular boilers from 80 to 250 h.p. our specialty.

Furnished complete with fixtures and fittings for setting either singly or in batteries as desired.

High Pressure Tubular Boiler

**Our new Boiler Catalogue is interesting. Send for Copy**

## The Jenckes Machine Company, Limited

**GENERAL OFFICES: Sherbrooke, Que.**

**WORKS: Sherbrooke, Que.; St. Catharines, Ont.**

**SALES OFFICES:** Sherbrooke · St. Catharines · Cobalt · Vancouver · Halifax

# SADLER & HAWORTH

## Oak Leather Belting

## *WHEN A LEATHER BELT*

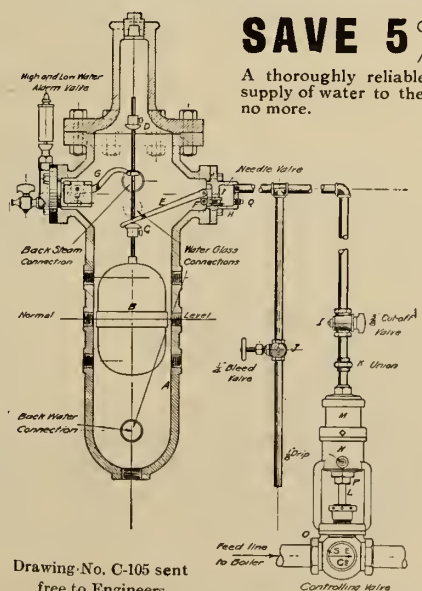
***Is not satisfactory It is a costly nuisance. You cannot afford to make mistakes. You run no risk when you buy***

## "CLIMAX"

# STANDARD AUTOMATIC BOILER FEED REGULATORS

## SAVE 5% IN FUEL

A thoroughly reliable machine that regulates the supply of water to the boiler just as required, and no more.




Drawing No. C-105 sent free to Engineers.

Maintains a constant level of water in the boiler, within one-half inch from where wanted. Gives you the maximum space for steam.

Saves expansion and contraction due to hand feeding.

Made of the best materials and built interchangeably on the Universal system.

All valves can be removed for inspection while boiler is in operation.

Absolutely prevents explosions due to low water.

Few and simple parts, therefore reliable in operation.

***A Necessity on Every Boiler.***

SEND FOR DESCRIPTIVE PAMPHLET—FREE ON REQUEST.

## The Standard Engineering Company

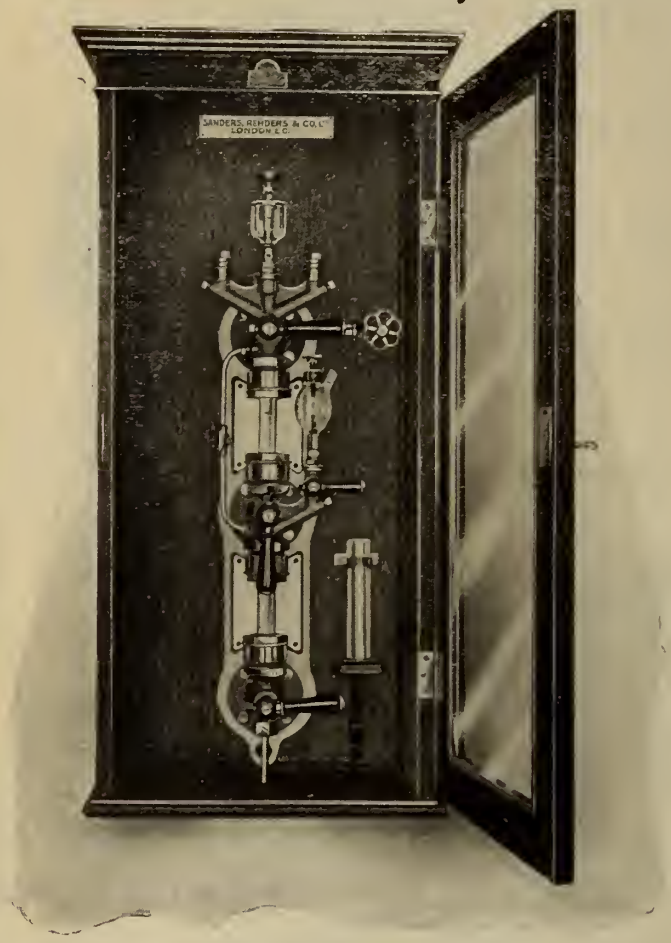
STEAM SPECIALTIES DEPARTMENT

234 Coristine Bldg., MONTREAL, P.Q.

43 Scott Street, TORONTO, CAN.

# Instruments that Positively SAVE MONEY

for every owner of a Steam Power Plant.

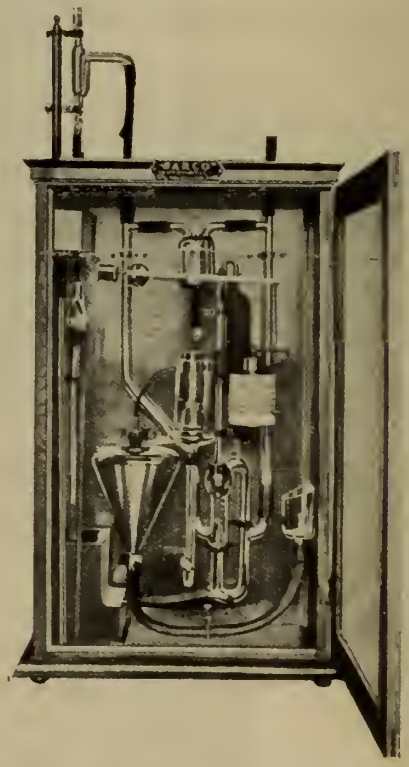



## Boiler Scale Prevention

is one of the toughest problems you have to face as the owner of a steam boiler. It is well known that Soda is the best preventative of Boiler Scale; the difficulty has been to know the right quantity to apply to the feed water. Thus more or less elaborate water softening plants often fail to prevent scale formation. But the problem has now been satisfactorily and inexpensively solved by the invention of the

## "SARCO"
## Feed-water Analyser

a small and simple instrument which analyses your feed water from day to day, infallibly indicating the exact amount of soda necessary to absolutely prevent the formation of scale in your boilers. We positively guarantee SARCO FEED-WATER ANALYSER to give an absolutely correct analysis of any feed-water to which it is applied.



## You Lose Money on Incomplete Fuel Combustion;

and if you had an instrument that would automatically tell you every hour just exactly how near perfectly your fuel was burning, you would save a lot of money; because "fore-warned is fore-armed." It would enable you to make provision to get a hundred cent's worth of combustion for every dollar's worth of fuel shovelled into your boiler furnace. There is such an instrument!—the

## "SARCO" Combustion Recorder

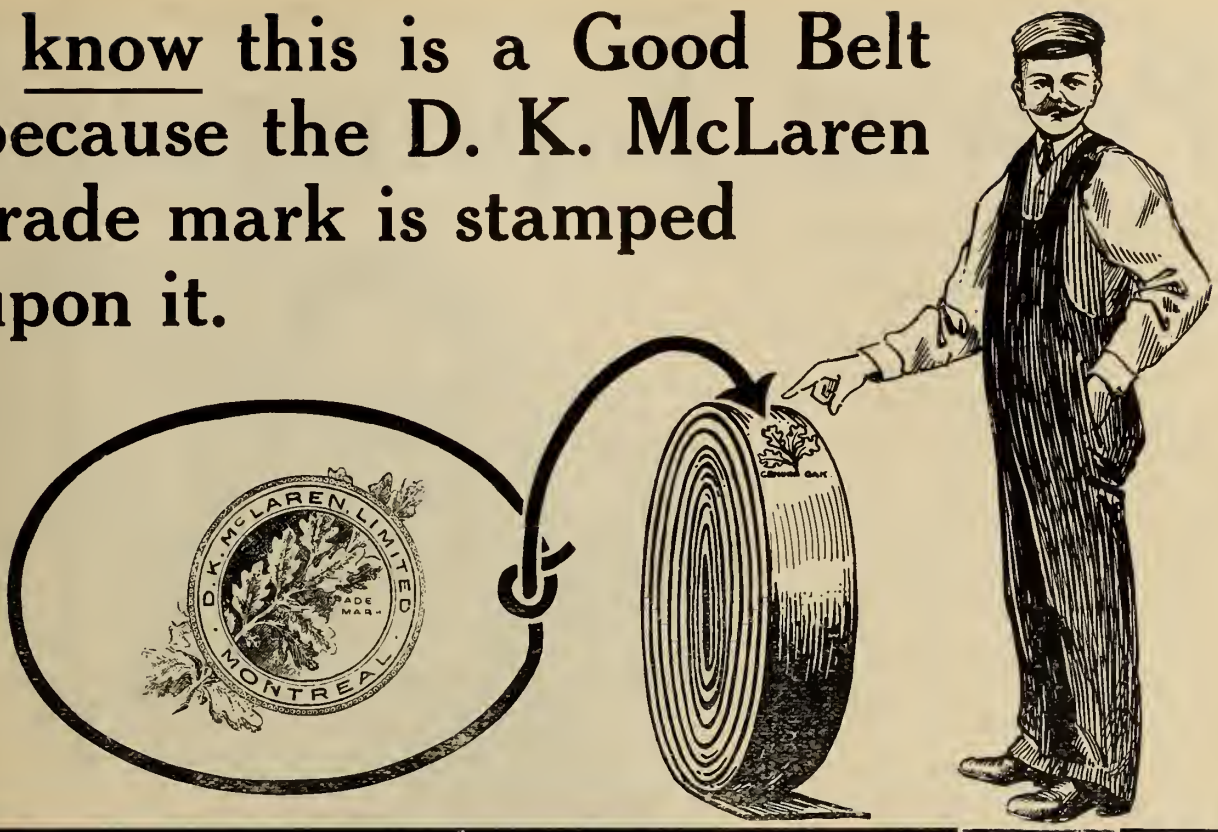
It automatically analyses the exit gases created by fuel combustion, and indicates upon a chart, in plain view all the time, the exact percentage of carbon dioxide which that gas contains. 20% Carbon Dioxide ($CO_2$) indicates practically complete combustion. Consequently the farther your furnace is from effecting complete combustion the more it is up to you to STOP THE WASTE.

Full particulars and prices sent immediately upon request.

# Canadian Instrument and Testing Co.

Montreal - - Canada

# I know this is a Good Belt because the D. K. McLaren trade mark is stamped upon it.




We claim that there is more solid leather to the foot in our belting than in any other make. Our belts are all **Genuine British Oak Tanned**—not Hemlock which is used in ordinary sole leather tannage and very often referred to as "Oak." We use no shoulders, necks or bellies in our Belting as all hides are close trimmed before tanning.

## Our Three Special Grades

**Made Only to Order.**

### WATERPROOF CEMENT

This brand is for use where the belting is exposed to conditions under which ordinary leather belts do not give satisfaction, such as bleacheries, laundries, breweries, etc.

### GIANT CRUSHER

Made from extra heavy selected stock of extreme weight and substance for heavy drives. This is the heaviest drive made, for cement plants, crushers, etc.

### SPECIAL MULE

An exceptionally heavy grade made in single only. Used where a double belt is handicapped by running over small pulleys at excessive speed. In substance and durability it excels a light double.

# D. K. McLAREN, LIMITED

**MONTREAL**
309-311 Craig Street West

**TORONTO**
200 King Street West

**QUEBEC**
21 St. Peter Street

**ST. JOHN, N.B.**
64 Prince William Street

**WINNIPEG**
Fred. J. C. Cox & Co., Representatives

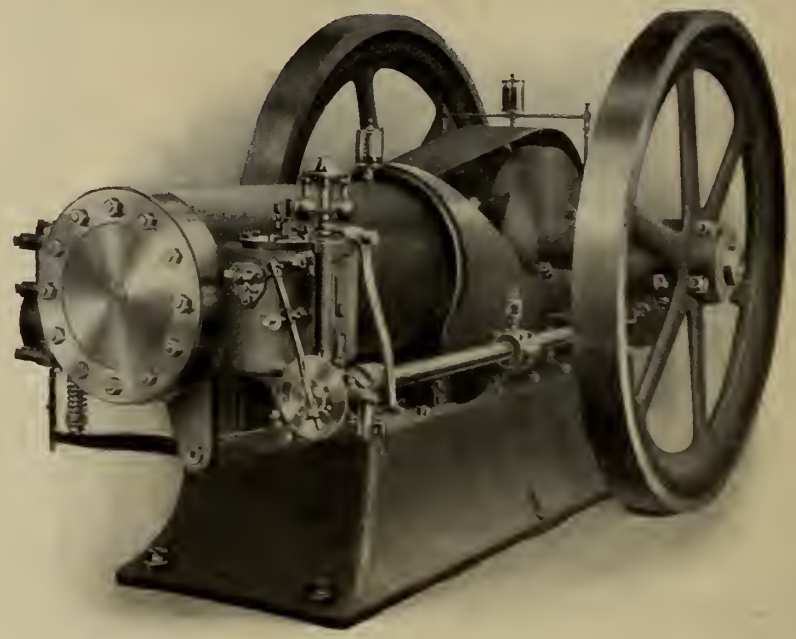
**VANCOUVER**
418 Abbott Street

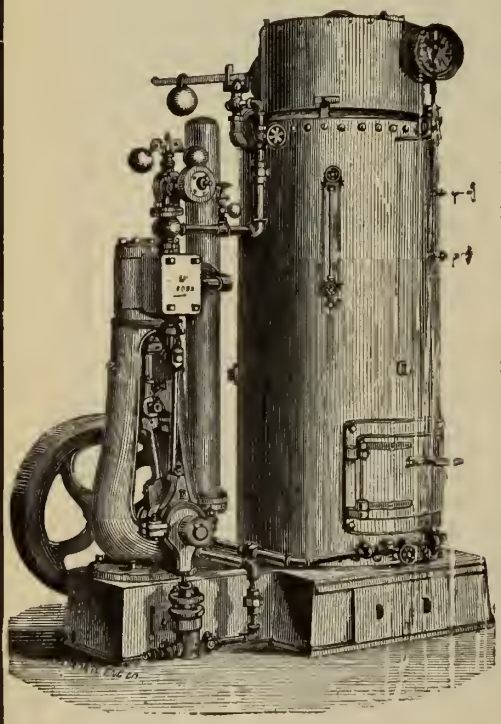
**Full stock of our "Extra C" Leather Belting and "D.K." Balata at above addresses.**

# Power Equipment

## Gasoline and Gas Engines

1 new 28 H.P. Ohio horizontal gas engine.
1 refitted 25 H.P. vertical marine gasoline engine.
1 new 21 H.P. Ohio portable gasoline engine.
1 refitted 15 H.P. Pierce horizontal gas engine.
1 new 14 H.P. Ohio portable gasoline engine.
2 refitted 14 H.P. Ohio horizontal gasoline engines.
1 refitted 10 H.P. Ohio horizontal gasoline engine.
2 new 8 H.P. Ohio portable gasoline engines.
1 new 4½ H.P. Defiance marine gasoline engine.
1 refitted 4 H.P. Ohio horizontal gasoline engine.
1 new 4 H.P. Ohio horizontal gasoline engine.
1 refitted 4 H.P. Otto horizontal gas engine.
1 new 3½ H.P. vertical marine gasoline engine.
1 new 3 H.P. Imperial vertical gas engine.
2 refitted 3 H.P. Imperial vertical gasoline engines.
1 refitted 2½ H.P. horizontal gasoline engine.
1 refitted 2 H.P. vertical gas engine.
1 new 1½ H.P. gasoline pumping engine.
1 new 1½ H.P. vertical marine gasoline engine.





## Engines and Boilers

1 refitted 9"x10" Abell semi-portable engine and boiler.
1 refitted 8"x10" White portable engine and boiler.
1 refitted 8"x12" semi-portable engine and boiler.
1 refitted 7"x10" Waterous portable engine and boiler.
1 refitted 7"x10" Victor portable engine and boiler.
1 rebuilt 7½"x12" Russell traction engine.
1 refitted 7"x10" Cornell traction engine.
1 refitted 48"x10'9" semi-portable boiler.
1 nearly new 30"x12' semi-portable boiler.
1 refitted 30"x10' semi-portable boiler.
2 refitted 5½"x7" vertical engines and boilers
1 refitted 4"x4" horizontal engine and boiler

## Automatic Engines

1 refitted 14"x34" R.H. Wheelock.
1 refitted 13"x30" R.H. Corliss.
1 refitted 12"x30" R.H. Corliss.
1 refitted 10"x26" R.H. Corliss.
1 refitted 9½" & 14½"x12" compound.
1 refitted 8" & 13"x18" compound.
1 refitted 12"x10" Westinghouse Junior.
1 nearly new 12"x12" Armington & Sims.
1 refitted 10"x10" Leonard Peerless.
1 new 10"x15" No. 8 Jewel.
1 rebuilt 7"x10" Leonard Ball.
1 refitted 6½"x9" Armington & Sims.

## Electric Motors

1 92 H.P. Westinghouse, 200 volts, alternating current, with transformers.
1 50 H.P. Jones & Moore, 200 volts, alternating current, with transformers.
1 15 H.P. Jones & Moore, 250 volts, direct current.
1 12 H.P. Consolidated, 250 volts, direct current.
1 8 H.P. Consolidated, 500 volts, direct current.
1 8 H.P. Consolidated, 250 volts, direct current.
1 8 H.P. Jones & Moore, 250 volts, direct current.
1 6 H.P. McLachlan, 500 volts, direct current.
1 5 H.P. Gee, 250 volts, direct current.
1 5 H.P. Three Rivers, 240 volts, direct current.
1 3 H.P. Jones & Moore, 500 volts, direct current.
2 2 H.P. Jones & Moore, 250 volts, direct current.
1 2 H.P. Three Rivers, 240 volts, direct current.
1 2 H.P. Jones & Moore, 110 volts, direct current.
1 100 K.W. alternating current generator.
2 100 K.W. direct current generators.
1 30 K.W. direct current generator.

**A copy of our supply catalogue or machinery stock list for the asking.**

# H. W. Petrie, Limited

**Toronto** **Montreal** **Vancouver**

*Hawkins Works*

## On Easy Payments.

Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

SPECIAL OFFER Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month (*when complete set is purchased the price is $12, being a saving of One Dollar*). **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed. ..... (*Firm Name*)

Home Address .....

**Every Manufacturer Using a Steam Boiler Should Know** that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)

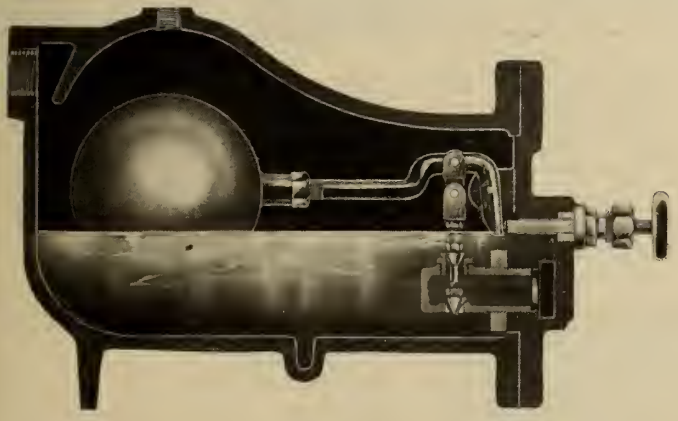
IS THE

## GUARANTEED BOILER CLEANER

Manufactured by

**The CANADA CHEMICAL MANUFACTURING COMPANY, Limited**

Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL



## The Modern Steam Trap

# Sheldon Continuous Flow Float Trap

**Adapted for High or Low Pressure Work**

Greater capacity than single valve traps.

Discharges continuously as fast as the water enters.

Double cone-shaped balanced valves operated by a high pressure seamless copper float, tested to 300 pounds pressure.

The conical shape of the valves makes it impossible for them to stick or be affected in any way by foreign matter which may enter the trap.

All working parts attached to the trap cover, which can be removed without disturbing the inlet or outlet pipe connections.

By-pass valve in cover so steam can be given a free passage around the valves when desired.

Casing provided with bosses which are tapped for gauge glass and air cock.

Write for Sectional Catalogue No. 56.

Eastern Agents:
**ROSS & GREIG**
**225 St. James Street**
**Montreal, P.Q.**

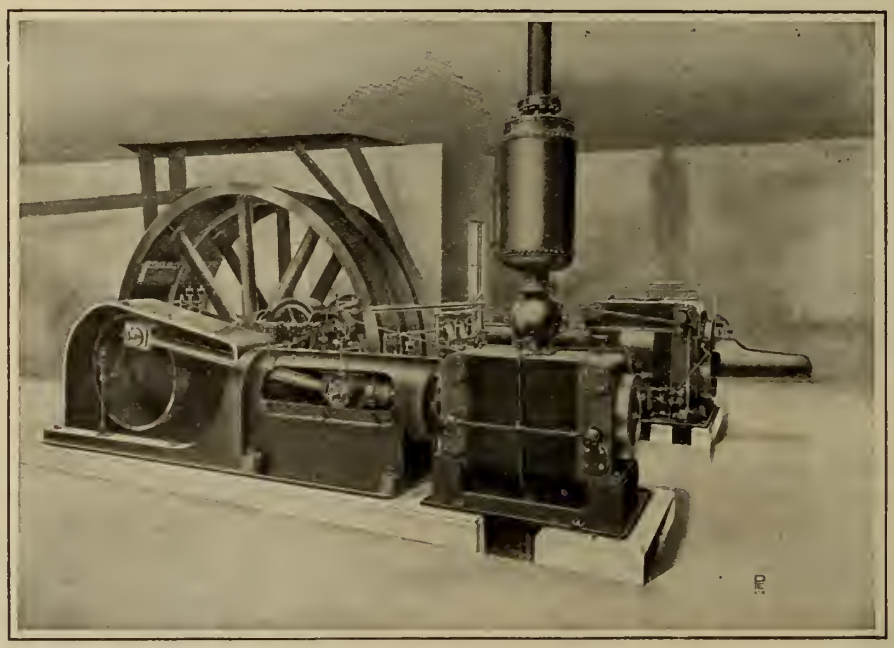
# SHELDONS LIMITED

**GALT, ONTARIO, CANADA**

**Stocked in all sizes for immediate shipment.**

## SOME OF THE USERS OF

# GOLDIE CORLISS STEAM ENGINES



Dominion Iron & Steel Co., Sydney, N.S.
Dominion Coal Co., Glace Bay, N.S.
Windsor, Essex & Lake Shore Ry., Kingsville, Ont.
Galt, Preston & Hespeler Elec. Ry., Preston, Ont.
Corporation of Prince Albert, Prince Albert, Sask.
Cosmos Cotton Co., Yarmouth, N.S.
Grand Trunk Railway System, Stratford, Ont.
Alexander Brown Milling Co., Toronto, Ont.
Corporation of Barrie, Barrie, Ont.
Superior Portland Cement Co., Orangeville, Ont.
Corporation of Strathcona, Strathcona, Alta.
Belleville Portland Cement Co., Belleville, Ont.
McGregor-Gourlay Co., Galt, Ont.
Corporation of East Toronto, East Toronto, Ont.
Lang Tanning Co., Berlin, Ont.
Canada Coating Mills Co., Georgetown, Ont.
Beardmore Belting Co., Acton, Ont.
Corporation of Indian Head, Indian Head, N.W.T.
Raymond Milling & Elevator Co., Magrath, Alta.
Galt Malleable Iron Co., Galt, Ont.
Farmers' Milling & Elevator Co., Prince Albert, Sask.
Corporation of Kincardine, Kincardine, Ont.
Lion Brewing Co., Berlin, Ont.
St. Lawrence Starch Co., Limited, Port Credit, Ont.
Ellison Milling & Elevator Co.,Limited, Lethbridge, Alta.
Standard Fitting & Valve Co., Guelph, Ont.
Waterloo Knitting Co., Hawthorne Mills.
Bathurst Lumber Co., Ltd., Bathurst, N.B.
Kaufman Rubber Co., Berlin, Ont.
The T. H. Taylor Co., Chatham, Ont.
Jas. Davidson, Ottawa, Ont.
Central Electric & Gas Co., Portage La Prairie, Man.
Strathroy Furniture Co., Strathroy, Ont.

## The GOLDIE & McCULLOCH CO., Limited

GALT, - ONTARIO, - CANADA.

WESTERN BRANCH:
248 McDermott Ave., WINNIPEG, MAN.

QUEBEC AGENTS:
ROSS & GREIG, MONTREAL, QUE.

B.C. SELLING AGENTS:
ROBT. HAMILTON & CO., VANCOUVER, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Boilers, Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Woodworking Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION.

# The Electrification of the G.T.R. Sarnia-Port Huron Tunnel

## Sketch of the Men Responsible for Successful Carrying Out of the Work— Power Plant, Including Jones Underfeed Stoker, Parson's Turbines, Etc.

The formal opening of the Saint Clair Tunnel, between Sarnia on the Canadian side and Port Huron on the American side was celebrated on November 12th. The electric zone is about 2¼ miles long. This electrification of the G.T.R. Tunnel is an important feature in the improvements this railway company has now under way. One of the heroes at the re-opening ceremony was

JOSEPH HOBSON.

Joseph Hobson, Hamilton, the veteran consulting engineer of the G.T.R., and former chief engineer of the system. He designed the tunnel and supervised the work in construction. At the time of the building of the tunnel Mr. Hobson suggested that electricity be used for hauling the train through the tunnel, but at that time, 1889 and 1890, electricity had not been sufficiently tested as a tractive power.

Bion J. Arnold, Chicago, was the engineer in charge of the electrification. His reputation is not confined to the United States and Canada, but is universal. He has done many great things before he undertook the electrification of the Saint Clair tunnel. He was the chief engineer in charge of the electrification of the New York Central terminal, which cost $15,000,000. He has directed many an electric work for many other railways, and is at present the Chairman and Chief of the Order of Supervising Engineers which is completing the re-building of the railways in Chicago at an expenditure of $40,000,000. The first impressive thing a visitor to his office sees is a map of America on which are small buttons marking the places where Mr. Arnold has work under way. His works include nearly all the important centres in America and it would take many pages to give the reader any idea of what he has successfully accomplished. The Saint Clair Tunnel is the first important project to demonstrate the efficiency of single phase, though it is not the first to be completed. The New York, New Haven and Hartford sections between New York and Wakefield was the first system to be completed.

Another photograph here shown is that of Mr. E. H. Fitshugh, the head of the Construction, Motive Power and Transportation Departments of the G.T.R. The work of electrifying the Saint Clair tunnel was recommended by Mr. Arnold, and accepted by Mr. Fitshugh. Another gentleman connected with the installation of the electrical locomotives at the Saint Clair tunnel is H. L. Kirker, of the Westinghouse Company.

In the September issue of The Power House we gave a description of these electric locomotives in a short article on the electrification of the Saint Clair tunnel. In this issue is a description of the power house located on the Port Huron side, but of such great interest to Canadians that it deserves being described in the columns of The Power House.

### Power Plant.

The power plant is located on the Port Huron bank of the St. Clair River, about 100 feet distant from the centre line of the tunnel. The building is 50 feet from the street property line, which provides ample space for a lawn in front, while the back building line is about 50 feet distant from the retaining wall, which serves as a dock line along the river. Sufficient space is afforded between the building and the river front for sidetrack, a spur of the G.T.R., which is used for bringing in

BION J. ARNOLD.

EARL HOPKINS FITZHUGH.
Third Vice-President G.T.R.

coal and various supplies needed for the operation of the power plant, as well as the removal of ashes. The proximity of the river makes it possible for coal to be received and handled by boat in case this should be found desirable.

The interior of the engine and boiler rooms are lined with pressed brick of a light grey color. In the turbine room a wainscotting 8 feet in height of white enameled brick is carried around the three sides of the room, in which the brick wall surface is exposed, the front side of the turbine room being given up entirely to the switchboard. The artificial lighting is taken care of by Nernst lamps.

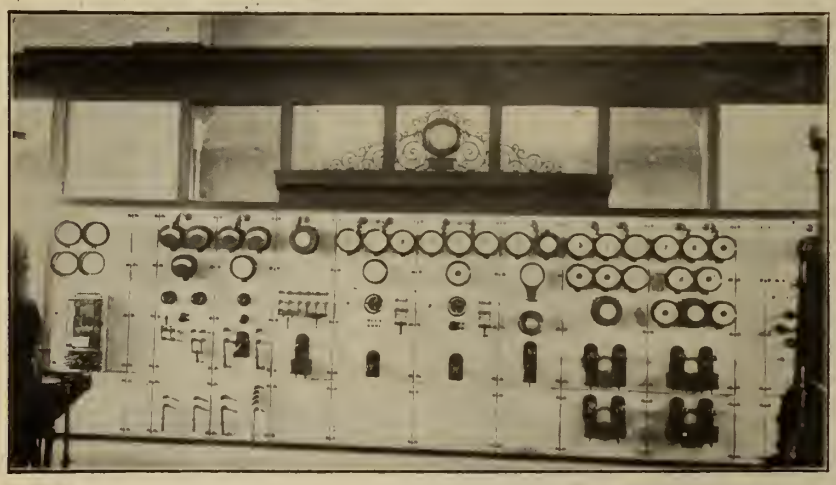
### Coal and Ash Handling.

Coal is delivered to the plant in hopper cars, which are run over a wooden trestle leading above the receiving hopper, into which it is dumped by gravity. The coal-receiving hopper feeds directly into the crusher, which has a capacity of about thirty tons per hour, and which acts at the same time as a feeder, delivering the coal at a uniform

rate to the vertical bucket elevator extending to the top of the building. From the vertical elevator the coal is fed by chutes onto a conveyor belt, from which it is discharged by an automatic tripper arranged to deliver the coal at any point above the bunkers.

Boiler Room, Showing Jones Underfeed Stokers.

Slow speed induction motors of the squirrel cage type drive the coal handling apparatus, a 20 h.p. motor being used in the crusher and a 10 h.p. motor installed in the pent house at the top of the building for the operation of the elevator and conveyor.



Switchboard in St. Clair Tunnel Power House.

The coal bunkers are constructed of reinforced concrete resting on the steel building columns. The space occupied by them, located in front of and above the boilers, is separated entirely from the boiler room by metal lath partition, thus practically insuring the exclusion of coal dust from the boiler room. In a similar way the coal crusher pit and the coal elevating mechanism are enclosed as completely as possible.

Coal for firing purposes is drawn directly from the bunkers, through sheet metal chutes, into the stoker hoppers, which are located in front of the boilers.

The ashes are drawn from the grates of the boiler furnaces onto the boiler room floor, where clinkers are broken and delivered through a coarse grating into the ash hoppers which are suspended underneath the floor. From the hoppers they fall by gravity through ash grates into the push cars, and are dumped into an ash chute connecting with the coal elevator. The elevator, when handling ashes, discharges into a spout leading to a small ash bunker at the end of the building. From this bunker they can be delivered by gravity into cars alongside the power plant.

### Stokers.

Jones Under Feed stokers are installed in the plant, six being used for each battery of two boilers, making a total equipment of twelve stokers. Forced draft is supplied for each battery by an American Blower Company steel plate fan 11 feet in diameter and 3 feet 5 inches wide, driven by 10x10x10 type B enclosed vertical engine directly connected to the fan shaft. These fans are located in the pit of the turbine room. By means of a special blast gate in the galvanized iron duct leading from the fans to the boilers, either battery of stokers may be supplied from either of the fans. Each battery of stokers is controlled by a Cole Automatic Regulator, which is driven from the shaft belted to the fan engines. Friction clutches on this shaft supply cross connection for driving either of the Cole

Power Generating Station, St. Clair Tunnel.

Regulators from either engine. This driving mechanism, together with the galvanized iron ducts and gates, is suspended from the ceiling of the boiler room basement.

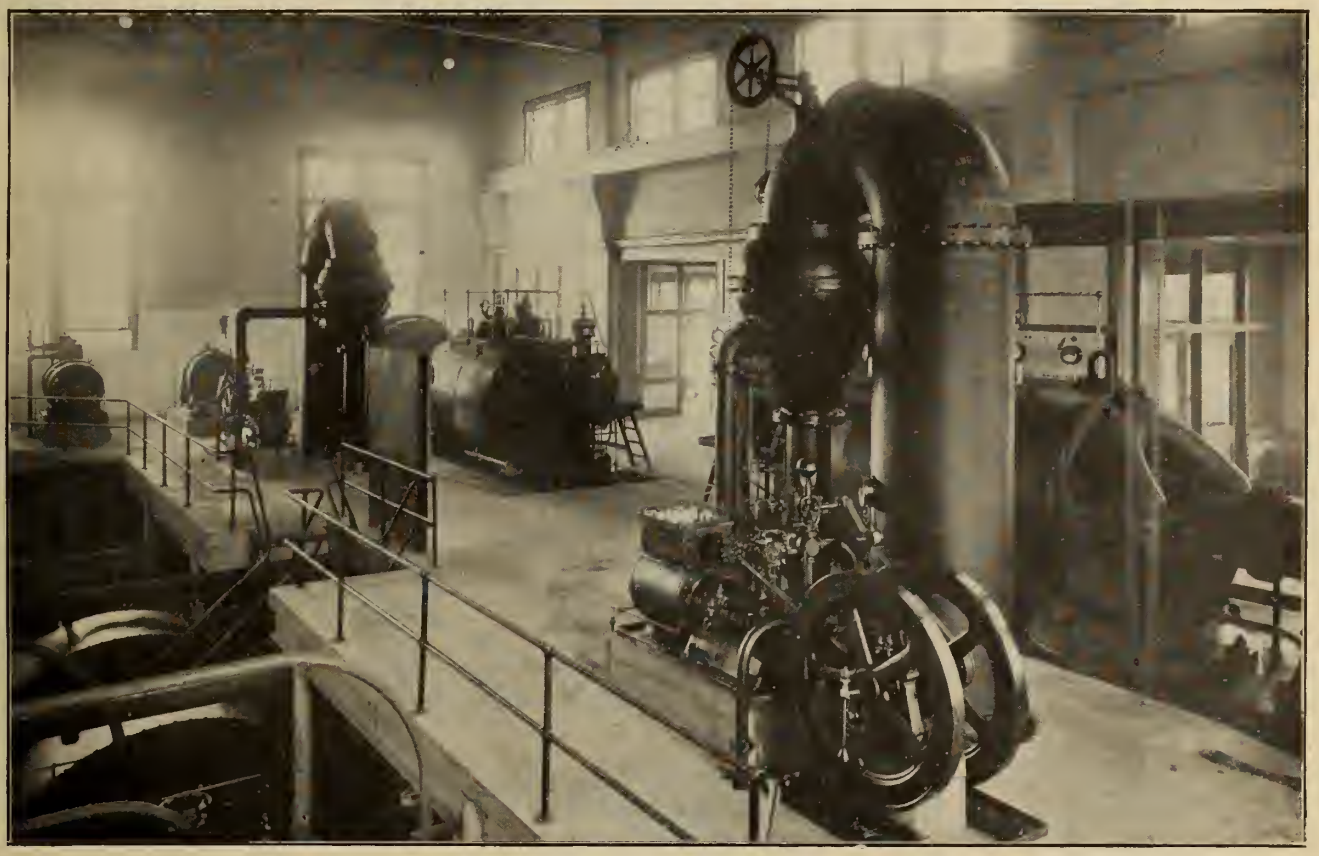
On account of the very great variation in the load on the power plant, special precautions were necessary for the control of the fires under the boilers, in order to keep the steam pressure fairly constant. This is accomplished by means of the Jones stoker equipment, which controls the fire automatically, both by regulating the air forced through the stokers and the rate of feeding of coal into the boiler furnaces. This regulation is accomplished by means of a Kitts regulating valve, which acts as a throttling valve on the fan engines. The potential piping leading from the regulator is connected to

the main steam header between the superheater and the turbine. In case the pressure in the steam lines tends to drop, the Kitts regulating valve increases the supply of steam to the fan engine, thus at the same time increasing the amount of air supplied to the boilers, and the frequency of operation of the stokers. In case the boiler pressure tends to rise, the Kitts valve decreases the supply of steam to the fan engine, thus decreasing the amount of air and coal supplied to the furnaces. This apparatus is entirely automatic, and has been found to control the steam pressure very closely.

The boiler equipment consists of four 100 h.p. Babcock & Wilcox sectional water tube boilers arranged in two batteries of two each. The boilers are designed to carry 200 pounds steam pressure, each unit being equipped with two tandem connected 2½-in. Morris blow-off valves, the necessary pressure gauges, water columns, etc. A 162' chimney built by Weber Steel-Concrete Co. furnishes draft.

### Superheater.

The separately fired Foster superheater is located between two batteries of boilers. The superheater has a capacity to add 200 degrees of superheat to 36,000 pounds of steam per hour. The superheater is provided with automatic temperature regulator, which, by admitting air either above or below the fires, serves to control the superheat within narrow limits, approximately 30 degrees. The regulator consists of a thermal coupling installed in the superheater steam outlet, which in turn operates through a relay and solenoid on the by-pass valve of the hydraulic cylinder, the piston of which directly controls the dampers in the air ducts. The regulating device is so adjusted as to provide a superheat of about 100 degrees under actual working conditions and has been found in operation to very closely control the temperature of the steam, notwithstanding the great variation of load to which the power plant is subjected.



Interior View of St. Clair Power House, Showing Turbines, Condensers, etc.

The steam is supplied by the boilers at 200 pounds pressure, and is delivered through the system of high pressure piping either to the superheaters and thence to the turbines, or through by-pass connections directly to the turbines, steam separators being installed in the piping system adjacent to the latter.

A 12-in. Cochrane oil separator is installed in the exhaust steam line just before it enters the feed water heater. Goubert type B vertical water tube heaters, each of 700 h.p. capacity, are used.

The condensing water is obtained from the St. Clair River, a concrete intake provided with structural steel grid and woven wire screen being installed along the dock line. From the intake the water flows through an 18-in. tile to the cold wells located below the centrifugal circulating pumps in the pit of the turbine room basement. Water is delivered from each of these by the circulating pump through the condenser, and is discharged into the hot well below the condensers. From the hot wells the water flows through an 18-in. pipe into a sump under the boiler feed pumps. These pumps deliver the water through the feed water heater to the boilers. The city water supply is connected to each feed pump by a 3-in. tap.

### Pumps.

Each battery of boilers is fed by a 12x6x10 duplex outside, end-packed Worthington boiler feed pump. In addition water is provided for various other purposes, such as cooling the lubricating oils in the turbines, supplying the glands of the turbines, for hose connections in and about the power plant, all of this being supplied by a small Burnham service pump, drawing supply from one of the cold wells.

### Turbo-generators.

Two Westinghouse Parsons turbo-generators have been installed in the plant. The machines are designed to operate at a normal voltage of 3,300

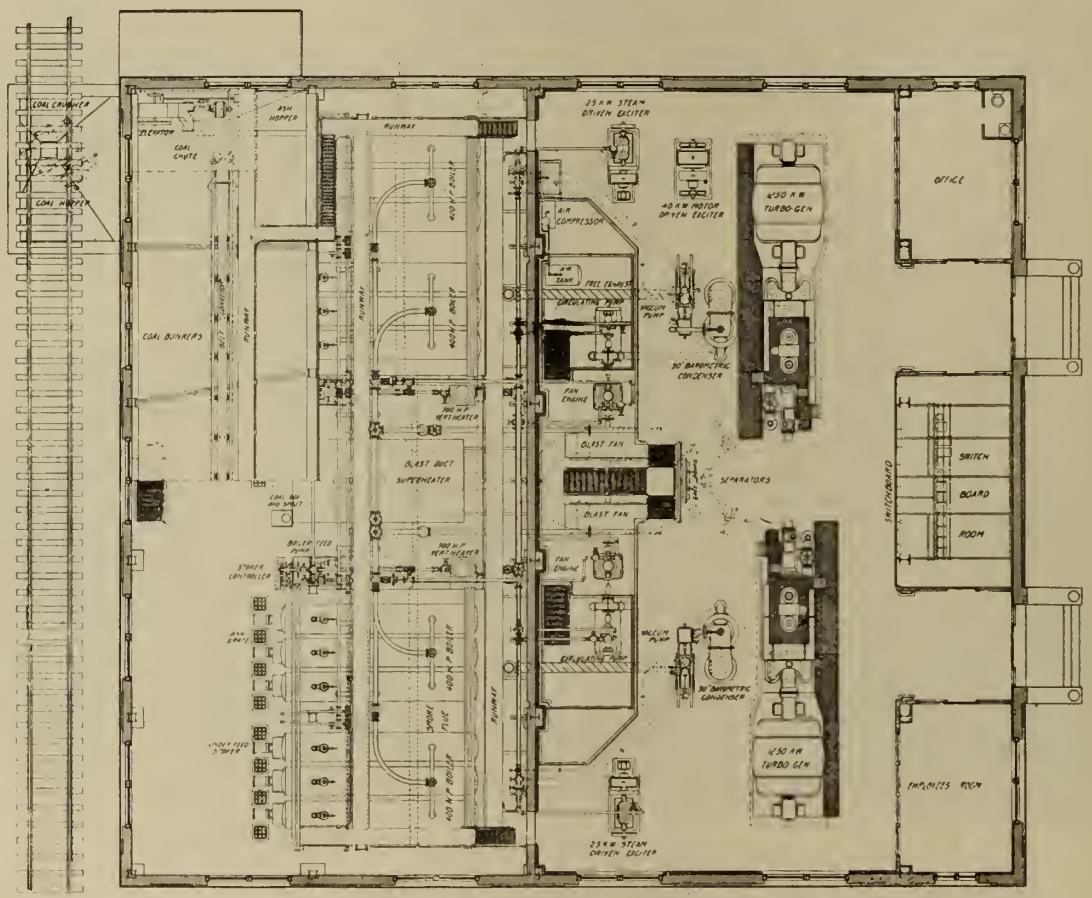
volts, with a frequency of 25 cycles per second. They are three-phase machines, but are further required by the specifications to furnish their full rated load of 1,250 k.w. single phase current. The turbines are approximately 37 ft. over all, 6 ft. in width, and 8 ft. high, and designed to operate at 1,500 r.p.m. The generators are cooled by means of air drawn through the coils by vanes installed on the rotor. A speed limit device is arranged to cut off the supply of steam in case the speed of the turbine exceeds a predetermined value.

### Condensing Equipment.

Barometric jet condensers with 30-in. inlet manufactured by the H. L. Worthington Company have been installed in connection with each of the steam turbines. A 36-in. exhaust pipe connects the exhaust outlet of the turbine with reducing fitting attached to the condenser head. A 14-in. automatic relief valve is installed in connection with the exhaust fitting, and connected to the free exhaust piping. The cooling water for each condenser is furnished by a 10-in. volute pump driven by 7x9 vertical engine. The rotative straight line vacuum pumps, 8x6x12 in dimensions, are supplied in connection with each condensing equipment. The dry vacuum pumps are located on the turbine room floor alongside the condensers, while the circulating pumps are located in the open pit in the turbine room basement, where they are in plain view from the turbine room floor.

### Exciters.

Two steam-driven exciters have been installed in the plant, each of 25 k.w. capacity, this being sufficient to provide excitation for a single turbine. In addition a motor-driven exciter of 40 k.w. capacity is installed, and is ordinarily used in the operation of the plant, the two steam-driven exciters being lor additional security so far as continuity of service is concerned. The generators of the steam-driven exciters are of the Westinghouse Electric Mfg. Co. make, and are driven by Westinghouse Machine Company vertical type engines. Both generator and motor of the motor-driven exciter are of Westinghouse manufacture, the motor being 3-phase, 3,300-volt, of the squirrel cage induction type.




Plan of St. Clair Tunnel Power House.

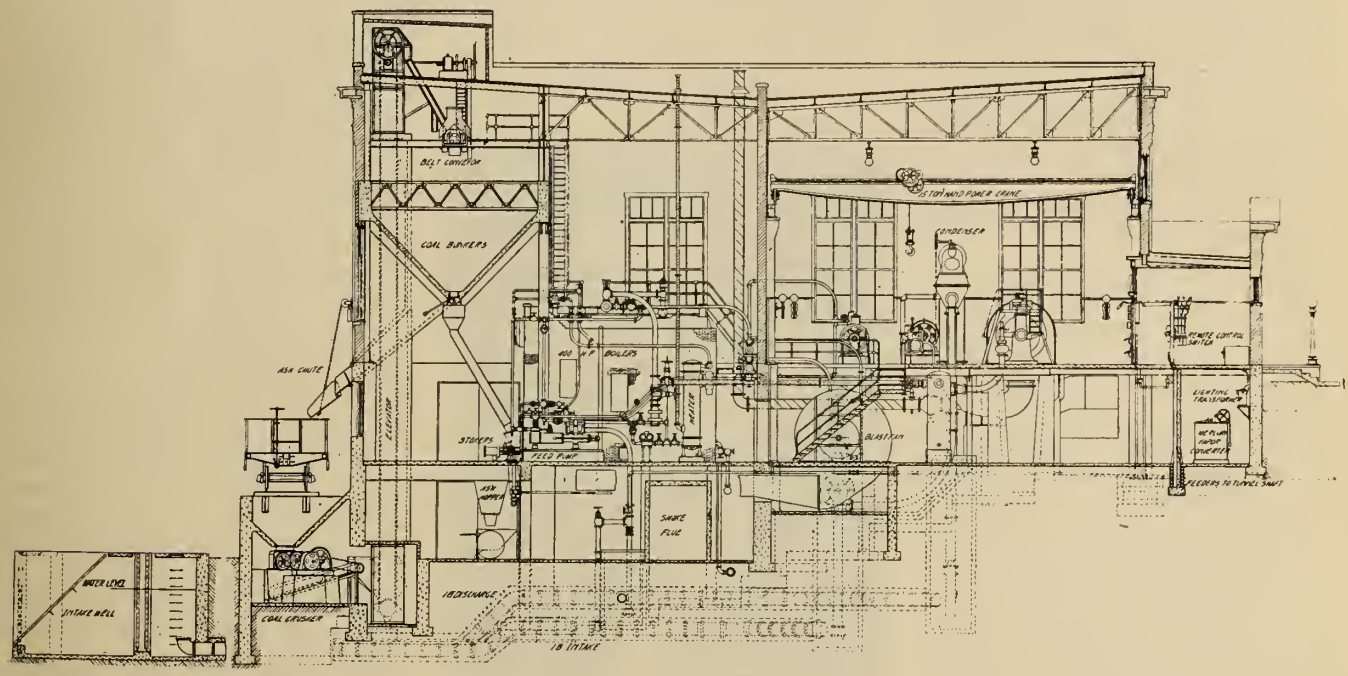
### Switchboards.

The switchboard, also of Westinghouse make, contains ten panels, and is made up as follows: One panel on which is mounted the Tirrill regulator, the voltmeters, frequency meter, and synchroscope; two panels, one of which controls the two steam-driven exciters, the second of which controls the motor-driven exciter; one panel for the control of the current supply for power and light in the plant; two panels for the control of the two turbo-generators; one panel for the locomotive feeder; one for the pumping feeders; one for the power and light feeders; and one for the control of the arc light circuits.

All of the high-voltage oil switches are located on structural steel frame work in the switch room directly behind the switchboard, no high-tension current being brought to the switchboard itself. Direct current at 125 volts is supplied for excitation, this being controlled from the main switchboard. The power plant lighting current is supplied as alternating current, through step-down transformers installed in a high-tension compartment underneath the switchboard room, by means of which the 3,300-volt current is transformed to 110-volt for lighting distribution in the plant. By means of a special switch the lighting system can be transferred from the secondary of the transformer to the exciter bus bars.

The switchboard panels are provided with standard apparatus, such as ammeters, voltmeters, and indicating wattmeters. Recording wattmeters have been installed as well, and so located as to measure the output of the plant required for the various kinds of service, namely, the locomotive service,

pumping service, and lighting service. The voltage control of the generators is provided for by the installation of a Tirrill regulator, which controls the voltage of the locomotive phase. The lighting load is carried on this phase as well, and is thus free from the large voltage variations that are liable to occur on the other phases.




Sectional Elevation St. Clair Tunnel Power House.

The station for the operating engineer is directly in front of the switchboard, from which point all the electrical indicating instruments, as well as the switches used in the operation of the plant are accessible. On the opposite side of the turbine room, facing the switchboard, is a gauge board, on which are installed the various gauges, both indicating and recording, giving full information with regard to the operation of the boiler plant. This arrangement brings to the immediate view of the operating engineer all information necessary in actual running of the plant.

A hand-power traveling crane of 15 tons capacity, manufactured by the Northern Engine Works, is installed on runways in the turbine room, by means of which all parts of the equipment in the room can be conveniently handled.

---

## A MINIATURE ENGINE.

When a steam engine is spoken of the word is associated with power. Engines, both steam and electric have been built capable of exerting thousands of horse-power. This one goes to the other extreme. One horse-power is sufficient to raise 33,000 pounds one foot in one minute at the earth's surface against the force of gravity. The horse-power of this miniature engine is 1-498,000 of one horse-power.

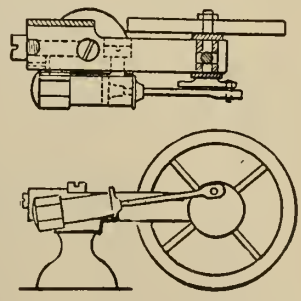
The engine was built by T. H. Robinson, 526 Yonge Street, Toronto, and it is considerably smaller than an ordinary house fly. The speed at which it runs is 6,000 revolutions per minute. The speed was estimated by tuning forks of known vibration. The first illustration is actual size, the 22 short cartridge being shown for comparison. One flea-power would seem more appropriate. A protecting covering, not shown, can be screwed down on the ebony base.

Actual Size of Miniature Engine and 22-Short Cartridge.

The engine is the smallest in the world and is made of gold and steel, and is so small that it fits easily into a 22 short empty cartridge, both balance wheel and stand. It weighs four grains troy, complete, that is about the weight of a common match. It takes 120 such engines to weigh an ounce, 1,920 to weigh one pound, and 3,840,000 engines equal one ton.

The engine bed and stand are of gold. The shaft runs in hardened and ground steel bearings inserted in gold bed. The bearings are counterbored from the inside to form a self-oiling bearing. The flywheel has a steel centre and arms, with a gold rim, and this part, the complete wheel, weighs one grain.

The cylinder is steel with octagonal base. The stroke is 1-32 inch, bore 3-100 inch. Seventeen pieces are used in the construction of the engine. The feed is through the gold base, which is hollow. When running at 6,000 R.P.M. no motion is perceptible to the eye, but it makes a noise like a mosquito, caused by the vibration of the piston rod. Fig. 2 shows the construction of the engine, which is of simple oscillating type.



Section of Miniature Engine Enlarged.

# Ontario's New License Law and Engineers' Examinations

## Regulations Governing the Engineers' Examinations—The Examiners in Ontario—Regulations in Use in British Columbia and Alberta.

The engineers throughout Ontario and members of the C.A.S.E. are particularly interested in the new regulations recently passed by the Ontario Government for the examination and granting of certificates for engineers. The Act for stationary engineers was passed in 1907 and amended in 1908. On November 5th the regulations printed in another column were approved by His Honor the Lieutenant-Governor, upon the recommendation of the Minister of Agriculture. The chairman of the Examining Board is Mr. W. C. McGhie. Mr. McGhie was born in the County of Peel, and attended the Parkdale Collegiate Institute. About fifteen years ago he started the study of engineering, taking a course with the International School of Correspondence, Scranton. He was Chief Engineer for Matthew Bros., picture frame manufacturers, Toronto, afterwards he was engaged for the Kemp Mfg. Co., Toronto Street Railway, Rolph & Clark, lithographers, Toronto. He was with this last named company when he received the appointment as chairman of the Examining Board.

In addition to Mr. McGhie, two other examiners have been appointed, and their photographs are given herewith.

W. C. McGHIE,

Chairman Examining Board.

It was intended that the appointments should be made one from the east and one from the west of the province. It was intended also that the board of examiners should be in session permanently but arrangements have now been made for the chairman to call them together in the same manner as the provincial board of health is called together.

CHARLES MOSELEY.

Examiner.

The two appointed are Charles Moseley and William Corrigan, both of Toronto.

Charles Moseley, 7 Charles Street, West, Toronto, is an Englishman who came to Canada in 1883. He was born in the county of Kent, England, and was first employed at Stevens Hooper, manufacturers of agricultural implements, for a period of nine years. After moving to Canada he was engaged as engineer with John Fletcher & Son, builders and contractors, for seven years. He was with North Toronto Electric Light and Waterworks for two years, and chief engineer of Incandescent Electric Light for eleven years. At the time of his appointment he was chief of Toronto Electric Light Co., where he has been for six years.

William Corrigan, 11 Atkin Ave., Toronto, was born in the north of Ireland, and came to Canada in 1885. He was employed as engineer at Toronto Electric Light for seventeen years. During the last two years he has been chief engineer of the new School of Physics, Toronto University.

In this issue we are giving also the regulations for engineers in Alberta and British Columbia, and in succeeding issues will be given the regulations in use by the several Provinces. It will be interesting to know by way of comparison the fees for stationary engineers' certificates. In Ontario, a fee of $3 is charged for a certificate, and $2 for a renewal. British Columbia, fourth class, $5, and $2.50 for each higher grade. Alberta, $3; Saskatchewan, $3, and Quebec, $5.

As will be seen by a perusal of the regulations, examinations will be held in London, Kingston, Ottawa, Port Arthur, Toronto and at such places as may be considered desirable by the board. It has been arranged also for examiners to visit the important centers during the first year so that engineers will not be put to heavy expenses for their examinations.

Some comments have been made by men interested in the examinations. At the 21st annual banquet of the Toronto branch of the C.A.S.E., Dr. Harper, of Quebec, in his reply to the toast of "Canada," said that engineers should be graded. In this connection it is interesting to note that when certificates were given to marine engineers in Eng-

WILLIAM CORRIGAN,

Examiner.

land, certificates of service were given, and then certificates of competence. Engineers who have been consulted think that there should be first and second class certificates. As the law stands now in Ontario, an engineer who has charge of a 50 h.p. plant or 1,000 h.p. plant will have the same certificate.

There have been several requests for information in regard to text books, but there is not one written that covers exclusively the field of the stationary engineers in Canada. A book covering the work of the different Provinces would be cumbersome, and a book written for one Province alone would have such a small sale that it would not pay to compile one. Several engineers have stated that they have found Hawkins Works very good. The difficulty is, however, that there are a great number of United States formulaes included. The handbook on electricity covers that field very thoroughly. The work generally is not too deep for the ordinary engineer.

### Revenue and Salaries.

There are approximately 6,000 engineers in Ontario who will require to take the examination and procure a license. At $3 per license there will be a revenue of about $18,000 the first year and about $12,000 for each succeeding year. Out of this will be paid the salaries and expenses of the department.

The salaries of these officials have not yet been fixed. The chairman of the Board of Examiners is an important position and the man who occupies it will be looked up to by both engineers and manufacturers who employ engineers. Much discretion must be shown by these examiners and they must be men of executive ability. The department has secured a man as chairman of the examining board who meets the approval of everyone. A good man in a good position requires remuneration in keeping with his position.

The following list of salaries paid by companies in Toronto is of interest.—Chief engineer of large power plant, $4,000, assistant engineer, $2,500; chief engineer of large office building power plant, $1,500, house, heat, water and light; chief engineer of steam electric plant, $1,500; chief engineer of a manufacturing plant, $1,500; engineer pumping station, $1,300, house, heat, light and water; chief engineer of waterworks, $2,200; his assistant engineer, $1,500; chief engineer hotel plant, $1,500 and board; boiler inspectors, from $1,600 up and traveling expenses.

The following are some of the salaries paid to some of the American examiners:—Ohio, $1,800 and $1,200 expenses; Montana, $1,800; Maryland, $1,500; Chicago, $1,700 and $1,500 expenses; Kansas City, $1,800, and California, $1,740.

Engineers feel that the chairman should receive a minimum salary of not less than $1,800. This is very reasonable and might be increased each year to a certain limit. The importance of the position must not be lost sight of. His standing among both manufacturers and engineers should be taken into consideration and the salary fixed accordingly.

### Ontario's Regulations.

The following regulations in regard to the examination of candidates for certificates of qualification and the granting of such certificates under the act respecting stationary engineers were, upon the recommendation of the Honorable the Minister of Agriculture, approved by His Honor, the Lieutenant-Governor, on the 5th day of November, 1908:

1. The board, or any member thereof, when authorized by the chairman, may examine candidates for certificates.

2. Candidates may be examined, subject to appointment, at any time during office hours at the office of the board at the Parliament Buildings, Toronto, and the board may conduct examinations twice in each year on such dates as may be determined,

(a) At the City of London;
(b) At the City of Kingston;
(c) At the City of Ottawa;
(d) At the City of Port Arthur;

and at such other times and places as may be considered desirable by the board.

3. Notice of the time and place of holding examinations shall be sent to each candidate living in the district in which the examination is to be held.

4. Candidates for examination shall apply to the chairman of the board on the form prescribed by the board, pay the prescribed fee, answer satisfactorily such questions as are required by these regulations, and obtain testimonials as to character and sobriety before they are competent to take the examination.

5. Candidates shall be examined upon a set of questions prepared from time to time by the board, and approved by the Minister of Agriculture, and (except when examined as provided in regulation 6) shall answer correctly at least sixty per cent. of the questions presented.

6. Where the board so decides, the examiner may examine a candidate orally on the questions contained in the examination paper, and have him demonstrate his knowledge of the operation of a steam plant in an engine and boiler room; and in cases where a candidate is examined in this manner, the examiner shall fill in on the examination paper so far as possible, the replies received to the questions asked, and shall state his opinion of the candidate's ability and whether or not he possesses a practical knowledge of the subject dealt with.

7. Candidates must appear personally before the board, or an authorized member thereof, for examination, and in no case shall examinations be conducted by mail, nor shall examination questions be sent to a candidate by mail, nor shall he be furnished or made acquainted at any time previous to the examination with the questions upon which he is to be examined.

8. Examination papers shall be passed upon at a meeting of the board at which all members are present before certificates are granted.

9. The length of time allowed candidates to write on any examination shall be determined by the board.

10. In the event of a candidate failing in his examination, ninety days shall elapse before he shall become eligible for re-examination.

11. The following shall be the form of certificate of qualification granted under the act:

Number

Ontario Department of Agriculture
Stationary Engineer's Certificate.
This is to Certify that

..... ..... ..... ..... ..... .....

is entitled under the Act respecting Stationary Engineers (7th Edward VII, Chapter 32) to operate and have charge of a steam plant of fifty horse power or over in the Province of Ontario during the year 19.... unless this certificate is sooner revoked, cancelled or suspended.
Dated at Toronto.....day of.....19....

.....
Chairman of Board of Examiners.

.....
Minister of Agriculture.

12. No certificate shall be granted by the board if, after investigation, it is shown that the applicant is habitually intemperate or addicted to the use of drugs, or is of unsound mind, or is physically incapacitated from performing his duties.

13. In the event of a certificate being lost, stolen or destroyed, the board may issue a duplicate thereof upon presentation of a statutory declaration, or other satisfactory proof, setting forth the facts.

14. Before presenting himself for examination, a candidate shall supply evidence satisfactory to the board

(a) that he has had not less than two years' practical experience as an engineer, fireman, oiler or assistant under the supervision of a competent engineer; experience in some allied trade or calling, may, at the discretion of the board, be counted on the required time;

(b) That he be of the full age of 21 years.

15. Every applicant for a certificate, or candidate for examination, shall ob-

tain a testimonial signed by three reputable persons stating that the applicant or candidate is temperate in his habits and of good character; but the board may demand such other testimony as to the character of the applicant or candidate as it may deem necessary.

16. Every certificate shall remain in force from January 1 to December 31 in each year, or from the date of issue until the expiration of the year in which it is issued, unless sooner revoked, cancelled or suspended.

17. The fee for examination (including certificate) shall be three dollars; and in the event of a candidate failing to pass, the fee shall not be refunded nor credited to him if he again presents himself for examination.

The fee for the initial certificate granted under Section 6 shall be three dollars.

The fee for renewing a certificate, and for the issuing of a duplicate certificate, shall be two dollars.

The fee for renewal of a certificate, where the holder has failed to register within the prescribed time, shall be five dollars.

18. The board may (subject to the provisions of Section 9) cancel a certificate where it is shown to their satisfaction that the holder

(a) Is habitually intemperate or addicted to the use of drugs;

(b) Has become insane or physically incapacitated;

(c) Has proved incompetent or grossly negligent in the discharge of his duties;

(d) Has obtained his certificate through misrepresentation or fraud;

(e) Has transferred his certificate;

and in no case shall a cancelled certificate be renewed until it be shown to the satisfaction of the board that the disability for which it was cancelled no longer exists.

Form D.

Application for Examination
Province of Ontario.

I, ..... of .....

hereby make application to the Board of Examiners to be examined for a certificate qualifying me to operate and have charge of a stationary steam plant of fifty horse power or over in the Province of Ontario under the provisions of the Act Respecting Stationary Engineers, Chapter 32, 7th Edward VII., and I herewith enclose the sum of three dollars to cover fee for same;

And I hereby affirm that I am of the full age of twenty-one years, and have been employed for not less than two years as an engineer, engineer's assistant, fireman or oiler under the supervision of an engineer at the following places and times, namely:—

*Dates covering 2 years' experience .....
..... ..... ..... ..... ..... .....
Nature of employment .....
..... ..... ..... ..... ..... .....
H.P. capacity of plant (approximate)
..... ..... ..... ..... ..... .....
Name and address of employer .....
..... ..... ..... ..... ..... .....
Signature of applicant .....
Address .....
(Street and number, if any.)
Province .....
Dated at .....
this ..... day of ....., 19.....

*Applicant must have had two years' experience in work associated with engines and boilers before being eligible for examination.

Testimonial.

(To be signed by 3 reputable persons.)

I hereby certify that (name of applicant) .....
is well known to me and that he is a man of sobriety and good character.

(1) Name .....
Address .....
Occupation .....

(2) Name .....
Address .....
Occupation .....

(3) Name .....
Address .....
Occupation .....

**Changes in Regulations.**

By Order-in-Council, dated 27th day of November, 1908, a number of changes were made to the regulations governing examinations and the granting of certificates under the Act respecting stationary engineers.

Sections 6, 7, 8, 14, 17 were amended to read as follows :

6. In all cases where the applicant for examination has had less than two years' experience as an engineer, fireman, oiler or assistant under the supervision of a competent engineer, and also in the case of any other applicant whom the board deem should be so examined, the examiner shall examine a candidate orally on the questions contained in the examination paper, and have him demonstrate his knowledge of the operation of a steam plant in an engine and boiler room; and in cases where a candidate is examined in this manner, the examiner shall fill in on the examination paper, so far as possible, the replies received to the questions asked, and shall state his opinion of the candidate's ability and whether or not he possesses a practical knowledge of the subject dealt with.

7. Candidates must appear personally before the board, or an authorized member thereof, or some person appointed by the board and approved by the Minister, for examination, and in no case shall examinations be conducted by mail, nor shall examination questions be sent to a candidate by mail, nor shall he be furnished or made acquainted at any time previous to the examination with the questions upon which he is to be examined.

8. Answers to examination papers shall be passed upon at a meeting of the board, at which all members are present before certificates are granted.

14. Before presenting himself for examination, a candidate shall supply evidence satisfactory to the board—

(a) As to his practical experience as an engineer, fireman, oiler or assistant under the supervision of a competent engineer ;

(b) That he is of the full age of 21 years.

17. The fee for examination (including certificate) shall be three dollars; and in the event of a candidate failing to pass, the fee shall not be refunded nor credited to him if he again presents himself for examination.

The fee for the initial certificate granted under Section 6 shall be $2.

The fee for renewing the certificate, and for the issuing of a duplicate certificate, shall be $1.

The fee for renewal of a certificate, where the holder has failed to register before the first day of February, shall be $5.

## ENGINEERS' EXAMINATIONS IN BRITISH COLUMBIA.

Applicants for examination for certificates of competency must fill in application form 12 and forward same, together with a fee of $5.00 on first examination and $2.50 for examination to be advanced to a higher grade. Copies of testimonials must be filled in under heading "D," giving the number of months' service, the kind of work engaged in, and the nominal horsepower of the boilers of which the applicant had charge, as follows:

**Fourth-class Engineer's Examination.**

One year as fireman, or as fireman and engineer, of a steam plant of not less than 5 nominal horse-power, or 12 months as mechanic in a workshop on the making and repairing of steam engines, boilers, etc., and 6 months as fireman or engineer of a steam plant of not less than 5 nominal horse-power. Applicant must be at least 18 years of age.

**Third-class Engineer's Examination.**

Two years as engineer of a steam plant of not less than 10 nominal horse-power, or three years as fireman; or two years as mechanic employed in a workshop on the making and repairing of steam engines, boilers, etc., and 6

months as engineer of a steam plant of not less than 10 nominal horse-power. Applicant must be at least 20 years of age.

**Second-class Engineer's Examination.**

Forty-eight months as engineer of a steam plant of not less than 100 nominal horse-power, or thirty-six months as mechanic in a workshop on the making and repairing of steam engines, boilers, etc., and 1 year as engineer of a steam plant of not less than 100 nominal horse-power. Applicant must be at least 21 years of age.

**For First-class Engineer's Examination.**

Sixty months as engineer in charge of a watch of a steam plant of not less than 300 nominal horse-power, or 4 years as mechanic in a workshop on the making and repairing of steam engines, boilers, etc., and 1 year as engineer in charge of a watch of a steam plant of not less than 300 nominal horse-power; he must also have been in possession of a second class certificate for 6 months. Applicant must be at least 22 years of age.

Sec. 15. When the workshop service has been performed in a place where engines are made or repaired, and the candidate has no service as engineer, the service may be accepted in lieu of engine-room service, with three years' additional workshop service, provided the chief inspector is satisfied that the workshop service has been such as would fit the candidate for a position as engineer of the grade for which the application is made.

Sec. 14. When the workshop service has been performed in a place where steam engines are not made or repaired, and the class of work done is similar to that required in engine making, the service may be accepted with an additional year as engineer.

The expression "engineer" means any person having charge of or operating a steam boiler under the provisions of this Act.

Sec. 16. Engineer in charge of a watch means being on watch for at least eight hours per day, and being responsible for the regulation of the feed-water and the general supervision of the boilers and engines during such period.

Applicants holding British Columbia certificates must give the grade and number under heading "D" on the application form.

In the event of an applicant sending in a form which appears to the chief inspector to be incorrect, an additional form will be forwarded for correction; when the applicant fills in this form he must state second or third application as the case may be, and under heading for fees, mention that they were enclosed with the first form, if this was done.

# Some Interesting Data on Composition of Producer Gas

## Influence on the Performance of Suction-Producer Plants—G. M. S. Tait Tells his Experience in Cassier's Magazine, and Draws his Conclusions

During the past four years suction producers have been gradually appearing upon the American continent, and quite a large number of instalations are now in operation, with more or less success.

However, unfortunately the defects noticeable in the older type of pressure producers, such as variation in the quality of gas, inability to clean the fire without interfering with the manufacture of gas, necessity for having a spare unit, etc., are all more noticeable with the suction type than with the former type of pressure producers, with which a large gas holder was usually employed for the purpose of steadying up the output of the instalation and allowing the gas to assume a more average condition before reaching the engine.

Almost without exception, some trouble has been experienced in every producer plant used for the operation of gas engines from irregularities in the operation of said engines, due to changes in the gas beyond the control of the operator, and it was with a view of ascertaining what these changes were, and to find, if possible, a remedy therefor, that the writer made a series of experiments on the subject, and with the following results:

In operating internal-combustion engines on a complex fuel, such as producer gas as usually manufactured, analysis of which I give herewith; it is noticeable that the heating value is composed of elements of widely different character, such as hydrogen and carbon monoxide.

| | Per Cent. |
|---|---|
| 1. Carbonic acid ($CO_2$) | 5.8 |
| 2. Oxygen ($O_2$) | 1.3 |
| 3. Carbonic oxide (CO) | 19.8 |
| 4. Hydrogen ($H_2$) | 15.1 |
| 5. Marsh gas ($CH_4$) | 1.3 |
| 6. Nitrogen (N) | 56.7 |
| Total | 100.0 |
| 7. B.T.U. per cubic foot of gas by calorimeter (high value) | 136. |

Following the matter up further, I made the discovery that the thermal or calorific value of the gas employed does not necessarily form a true index of the power value of gas for engine work, and this was proven in the following manner:

An internal-combustion engine of the three-cylinder vertical type, rated at 100 h.p. om producer gas containing 13.3 per cent. hydrogen and 23.8 per cent. carbon monoxide (plus a small percentage of marsh gas) and having a total calorific value, as determined by the calorimeter, of 138 b.t.u. per cu. ft., was found to develop a maximum under the very best conditions of 106 h.p. By the very best of conditions, I mean with the fuel in the producer free from clinkers and of sufficient gasifying depth to create a temperature to give the best results.

After obtaining this horse-power, I removed the apparatus for feeding steam beneath the bed of the producer, with a view to eliminating the hydrogen constituent in the gas. The gas under this condition showed 24.3 per cent. carbon monoxide, which constituted practically the sole combustible matter in the gas (with the exception of the small percentage of marsh gas above alluded to), this gas having a calorific value of 91 b.t.u. per cu. ft. With this gas and the same engine I developed 114 h.p. with ease, and was enabled to carry a load until the fire in the producer became overheated.

I then employed the exhaust from the engine under the fuel bed in the producer for the purpose of diluting the incoming air and reducing the temperature of the fuel bed. (In doing this, I was utilizing a patented process for flame and combustion temperature regulation now very largely known in several industrial fields.)

Going a step further, I increased the compression of the engine to 200 lbs., on the assumption that, with no hydrogen in the gas, the tendency to pre-ignite would be absent, and the attendant advantages might as well be derived.

With this arrangement the producer operated with entire satisfaction twenty-four hours per day, with full or vary-

ing loads, while the engine, on the other hand, gave no trouble whatever, and there was an entire absence of pre-ignition, back-firing, etc., troubles which had been noticeable before. In addition to these advantages, the engine developed a maximum of 126 h.p., and would carry 110 h.p. with the greatest ease continuously, while, due to the high compression and accurate ignition produced when using a gas containing only one active constituent, the efficiency of the engine increased 15 per cent. above its former rating; that is to say, the total efficiency of the engine was 26 per cent. under these latter conditions.

When it is considered that the gas used in the second instance contained 47 b.t.u. less per cu. ft. than the gas used in the former test, and that in the face of this the efficiency of the engine and the horse-power capacity both increased to a marked extent, some idea of the importance of this deduction will be appreciated.

I found that this increase in horse-power efficiency is due primarily to the fact that mixtures of gases whose components burn at different rates or velocities, such, for instance, as the usual mixture of carbon monoxide and hydrogen, usually known as producer gas, are not well suited for engine practice, and do not represent, by their total heating value, the amount of work obtainable from them in a gas engine cylinder, for ignition is either too early for the hydrogen, which is a gas of extremely combustible character, or else ignition occurs too late for the less combustible or slower burning carbon monoxide. Either state of affairs causes a loss of power, pre-ignition, back-firing or late ignition.

At the present time the chief difficulty in operating internal-combustion engines with producer gas arises from the great variation in quality of the combustibles contained therein, which necessitates the closest attention on the part of the operator and the frequent adjustment of the air and gas valves on the engine, and it was while working out the cause of these variations and the remedy therefor that I made the above-mentioned discovery, that the thermal value of gas does not indicate its power value in an engine when it contains more than one combustible element, and that, owing to changes in the temperature of the fuel bed in the producer supplying the engine with gas, affected in turn by variations in the load on the engine, it is impossible to produce a gas containing fixed proportions of hydrogen and carbon monoxide; for, on the one hand, when the plant is running under a low load, the fuel bed, being cooler, will allow part of the steam to pass up through the fire without dissociation, merely superheating same, and this superheating of necessity carrying off heat units which are in turn lost in the scrubber water without having performed any useful work.

Owing to this varying quality of the gas, the time of ignition is rarely accurate, and this state of affairs gives rise on the one hand to pre-ignition and on the other hand to back-firing.

It, therefore, would seem that in order to secure a constant, regular and steady run from the gas engine, only one combustible element should be present in the gas used. If the presence of other combustible matter, such, for example, as marsh gas, is unavoidable, the quantity should be restricted to the least possible amount.

When producer gas is made, as has already been mentioned, by the passage through a fuel bed of a draft current containing air alone, provided that the fuel used consists largely of carbon, such as anthracite coal, charcoal or coke, the gas as produced contains only one combustible, namely, carbon monoxide, the balance of the gas being inert nitrogen.

Provided all the oxygen admitted is reduced to carbon monoxide, the finished gas should contain, theoretically, 34.7 per cent. of this monoxide. Each per centum of carbon dioxide present reduced to carbon monoxide being 2 per cent., inasmuch as one molecule of carbon dioxide contains two atoms of oxygen, while carbon monoxide contains one atom, and consequently one-half of the oxygen of carbon dioxide. In other words, one volume of carbon dioxide on reduction by carbon will produce two volumes of carbon monoxide.

For the prevention of clinkering of the producer and for the purpose of so-called enriching of the gas, steam has hitherto been used, mixed with air, as the ideal blast for producers, it being claimed that the steam in the blast supplied a certain amount of oxygen for the oxygenation of carbon, without however, introducing nitrogen at the same time.

Hydrogen is produced in direct proportion to the amount of steam decomposed. It has been supposed, therefore, that hydrogen, in raising the heating value of the gas, increased its power value in an engine, and as for this reason, the greater the amount of steam employed, other conditions being equal, the higher the percentage of hydrogen; thus it was assumed that a greater value from the engine standpoint was obtained in the gas. However, as above mentioned, it will be seen that the assumption that the greater the proportion of hydrogen, the greater will be the power developed by each cubic foot of gas in the gas engine cylinder, is erroneous. It is true that a gas producer, under a pure air blast, will generally give a product having a lower calorific value per cubic foot than those operated with steam and air in conjunction; but it is not true that such a gas is a better agent for the development of power than a hydrogen containing gas. On the contrary, it is a far superior gas for power development in every practical respect, even though the gas so made should have one-third less thermal value than that of ordinary producer gas; the very fact that the former contains only one active combustible, with a fixed ignition point and adaptable to high compression, gives it the property, as already mentioned, of developing more actual power in an engine for reasons above mentioned.

It would seem, from the writer's experience, that this simple change in the lay-out of a producer plant has brought this character of instalation up to a point of reliability, while at the same time, so far from losing any of the acknowledged economies of producer-gas-operated gas engines, the efficiencies are considerably increased.

It is interesting to note that engines employed under these conditions operate under compression upward of 200 pounds with entire freedom from pre-ignitions, proving conclusively that in whatever way hydrogen may or may not affect the pre-ignitions, they are not present in its absence.

---

## ELECTRIC SMELTING AND PRODUCER GAS ENGINES.

Dr. Eugene Haanel, of the Geological Survey, is in Sweden on the invitation of the Government of that country, to attend the opening of the new electric smelting plant at Dumnarfot. He will continue for the mines department the investigations he made some two years ago on the electric smelting process, now coming into vogue in Europe, and on his return further important developments in the plant already started at Sault Ste. Marie in connection with the new system may be expected.

Dr. Haanel will also investigate the results of the latest experiments and discoveries made in Europe in connection with the use of producer gas engines for industrial purposes. This new form of production of energy is being largely adopted in certain parts of the continent, and experts say it is fraught with great possibilities to the industrial world. New methods have recently been discovered making bituminous coal as well as anthracite available for power production in the producer gas system, and Dr. Haanel will bring back to Canada the very latest information procurable on the subject.

# Course of Lessons for Instruction of Stationary Engineers

First of a Series of Lessons to be Given for the Instruction of Engineers — These Articles will Take up in a Simple Manner, Steam, Gas and Electrical Engineering, and will be Both Interesting and Instructive.

By W. A. CROCKETT.

## HEAT, SENSIBLE AND LATENT.

Heat is a form of energy, and also a kind of motion. Science assumes three divisions of matter—masses, molecules and atoms. A mass is any portion of matter appreciable by the senses.

A molecule is the smallest particle of matter into which a body can be divided; it is the smallest particle that is capable of separate existence.

An atom is the still smaller particle produced by the division of a molecule by chemical means.

A molecule is a group of two or more atoms. Notwithstanding the minuteness of molecules, they play an important part in the heat theory.

Every molecule has a rapid vibratory motion to and fro and are held together by what is called cohesion.

When heat is applied to a body this vibratory motion increases in proportion to the amount of heat supplied, when enough heat is added to a solid the force of cohesion is lessened and the body melts. Heat is of service to man in two ways, it keeps him warm and it does a great deal of work. The object sought in this and following papers is to bring to the mind of the reader a clear conception of the methods and means by which heat is of service to us as a lightener of toil.

### Sources of Heat.

There are many sources of heat, the sun, the earth, friction, concussion, animal processes and chemical processes. Heat is a mode of motion, not motion that we can see or feel as motion, but infinitely small and rapid vibrations of the particles of a body. When we impart heat to a body we simply increase the rate and extent of the vibrations of its particles. When we cool a body we decrease this vibration. If we could cool a body to such a temperature that all motion of its particles were stopped then it would contain no heat, and it would be at "absolute zero."

The effects produced by heat bear out this theory. We all know that a body when heated expands, but some bodies do not always expand when heated, as for example, water. When water of 32 degrees is heated to 33 degrees its volume decreases and this continues until a temperature of 39.2 degrees has been reached; beyond this point the volume increases with the temperature. Of course, when the weight remains the same and the volume grows larger the density decreases. This apparent contradiction of the heat theory is caused by atmospheric pressure; the heat added to the water until 39.2 degrees is reached gives a freer movement to the molecules and thus enables the pressure of the atmosphere to force them closer together.

The amount of heat given us each day by the sun is enormous. It is estimated that the sun gives to each acre of earth's surface the equivalent of 175 horse-power during each hour of daylight, or 800,000 horse-power per year. We have not yet learned to utilize this source of energy, although this may sometime be an important problem. Down deep in the earth we find plenteous stores of coal, the remnants of a decayed vegetation, every bit of whose energy came originally from the sun.

If we heat a solid body hot enough its particles are pushed so far apart that it becomes a liquid; if further heated it becomes a gas.

The difference between heat and temperature must be clearly understood. The temperature of a body gives us no idea of the amount of heat it contains. The amount of heat in a body cannot be determined from its temperature alone. Neither can we determine the temperature of a body from the way it feels to us. For instance, a piece of iron may feel cold to the touch, while a piece of wood of the same temperature feels warm.

### Latent Heat.

Heat may travel through a body in three different ways—by conduction, by connection and radiation. Sir William Thomson says: Heat given to a substance and warming it is said to be sensible in the substance. Heat given to a substance and not warming it is said to become latent. If a quantity of pounded ice at a temperature of 32 degrees be put in a vessel where it can be heated uniformly at the rate of 18 units per minute, heat passes rapidly into the ice and melts it, but a thermometer resting in the mixture of ice and water remains at 32 degrees until all of the ice has been melted. Where has the heat gone that was supplied to the ice? A pound of water and a pound of ice being placed in two vessels and kept at a uniform temperature for half an hour, the temperature of the water was 39.2 degrees, but the ice did not reach this temperature until $10\frac{1}{2}$ hours had passed melting. It is to be assumed that the ice received the same quantity of heat that the water did in each half hour, i.e., 39.2 degrees minus 32 degrees, equals 7.2 units of heat every half hour, or 14.4 units every hour, and 14.4 x$10\frac{1}{2}$ equals 151.2 units in that time. Therefore, it took 151.2—7.2 equals 144 units of heat to change the pound of ice at 32 degrees into water at 32 degrees. This shows that 144 units of heat have been spent without increasing the sensible heat of the substance. These 144 heat units have become latent in the water. According to some investigators more accurate determinations have fixed this number as 142.65.

If heat is applied to 1 lb. of water at 32 degrees it will in 10 minutes receive 10x18 equals 180 units, which raises it to boiling point 212 degrees. It will continue to boil and become converted into steam until in 53.7 minutes the whole is so changed. During this change its temperature will remain steadily at 212 deg. Therefore 53.7x18 equals 966.6 units will have become latent in steam. If a pound of water having a temperature of 212 degrees be mixed with a pound of water at a temperature of 32 degrees, the temperature of the mixture will be $\frac{212+32}{2}$ equals 122 degrees, the boiling water giving up 90 degrees, and the cold water receiving 90 degrees. If a pound of ice at a temperature of 32 degrees be mixed with a pound of water at a temperature of 212 degrees the temperature of the mixture will be only 50.675 degrees. Here the water has given up 212—50.675 equals 161,325 units of heat..

The ice being raised from 32 degrees to 50.675 degrees it naturally follows that 50.675 degrees minus 32 equals 18,675 units of heat were used to raise the temperature of the ice after it had been melted into water, and 161.325—18,675 equals 142.65 units of heat were necessary to convert the ice at 32 de-

grees into water at the same temperature.

This extra number of heat units necessary to convert a solid into a liquid of the same temperature without raising the temperature of the solid is called the latent heat of fusion, and the melting point is the temperature at which this change of the body takes place, it is also called the temperature of fusion.*

If water be heated to 212 degrees its boiling point under a constant pressure of 14.69 lbs. per square inch, it will require 966 units of heat per pound of water to change it into steam at 212 degrees. This heat does not raise the temperature, but disappears in convert the liquid into a gaseous state, and is called the latent heat of evaporization. The temperature at which this change takes place is called the temperature of vaporization. Total heat of evaporization is the sum of the latent and sensible heats of evaporization.

Thus, for instance, a pound of steam under a pressure of one atmosphere contains 966 plus 180 equals 1,146 units of heat more than does a pound of water at 32 degrees. Therefore, if one pound of steam at 212 degrees be mixed with

$$\frac{966}{180}$$

equals 5.37 lbs. of water at 32 degrees, the temperature of the mixture will be exactly 212 degrees, i.e., the steam raised 5.37 lbs. of water from 32 degrees to 212 degrees without lowering its own temperature.

If steam is generated at a higher temperature than 212 degrees the sensible heat increases and the latent heat decreases. Latent heat plays an important part in everyday life.

---

### UNIQUE PRODUCER GAS INSTALATION.

The Gendron Mfg. Co., 137 Duchess Street, Toronto, have installed a French producer in which the shavings and refuse from their factory are utilized for the manufacture of gas. The plant is now in running order with a 100 h.p. Tangye engine. Another engine of the same capacity has been ordered and will be installed at once. The saving in fuel is estimated at one carload a week. In a succeeding issue of The Power House we will give a description of the complete power equipment.

*Some authorities take 144 units as the latent heat of fusion of ice, while others take 142.65 units.

# Transmission Line of Hydro-Electric Commission

## Turning of the First Sod of the New Power Line by Mayor Fryer, Galt, Marks Beginning of Construction of a Great Electrical Undertaktng.

The first sod of Ontario's power line was turned on Wednesday, November 18th, by J. H. Fryer, Mayor of Galt. Six years ago the work in connection with this power scheme was undertaken and the turning of the first sod of the Ontario Government's Power Transmission System of 293 miles of line, is an important step in the carrying out of the work. This project was advocated by the manufacturers of Western Ontario at Berlin in 1902. It was investigated by Municipal Commission formed in 1903, and undertaken by the Royal Commission appointed in 1906. The ceremony was presided over by Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, who has concluded a careful enquiry and negotiations preceding the undertaking of this great public enterprise.

Mr. Beck, speaking at the ceremony, said that in June, 1902, it was seen that it was practical to obtain cheap power by utilizing the water powers, and since then the work has gone forward steadily. The current will be carried from Niagara at a pressure of 110,000 volts on the wire, which is 10,000 volts higher than any other transmission line in the world. The current will be purchased from the Ontario Power Co. at 12,000 volts at $9 per h.p. per year. Upon delivery a commission will step this voltage up to 110,000 volts. In connection with the transmission line Toronto passed a by-law, January 1908, authorizing an expenditure of $2,700,000, in a distributing system. Mr. K. L. Aitken, Electrical Engineer, has charge of the construction of the distributing system for Niagara power.

The stations reached by the transmission line will be twelve in number, and will be built at the following points, Niagara Falls, Dundas (combined transformer and interswitching), Toronto, Brantford, Woodstock, London, Guelph, Preston (supplying Waterloo and New Hamburg), Stratford, St. Mary's and St. Thomas. Stratford and St. Mary's will depend on the passage of the Stratford by-laws. The tenders for apparatus for interswitching and transforming the electric current to be brought from Niagara, and the cost of this portion of the equipment is considerably below the estimate of $1,107,000, made by the commission's engineers. The contract for construction of the transmission line was awarded to the F. H. McGuigan Construction Co., Toronto, for $1,270,000. There will be required in all more than 3,000 towers in the 293 miles of transmission line. Three cables each suspended from a separate insulator will form a single circuit. By far the greater number of them will be two-circuit towers, carrying six cables each, there being also the ground line and a line for lightning protection. The towers will be 558 feet apart, except at special points where longer distance is necessary. The cable will be of aluminum, manufactured by the Northern Aluminum Co., Shawinigan Falls, Que. There will be 1,014,209 pounds used. There will also be 3,176 towers, 66 feet high, consuming 6,554 tons of steel, costing $621,000. These will be manufactured by the Canadian Bridge Co., Walkerville, and the Ontario Iron & Steel Co., Welland.

Should Eastern Ontario and perhaps Northern Ontario ask for the same power privileges as the West, there is a clause providing that the same length of additional line may be erected upon the same terms.

### The Situation in Hamilton.

In Hamilton the first important point at which power will be furnished by the Government, there is a private company furnishing power. This company started many years ago to furnish electricity for street lighting and railway system from steam plants. About ten years ago this company utilized the power at DeCew Falls, 34 miles from Hamilton, constructing a power plant, machinery, buildings and a pole line to Hamilton for the transmission of electrical energy. The price for power is far below that of the steam power. Natural gas, with which Hamilton is supplied, also furnishes a cheap power to small users.

### Situation in Toronto.

Two writs were issued to prevent Toronto from contracting with a commission. The claims made in the writs that the Electrical Development Co. and the Toronto Electric Light Co. are now lawfully entitled to hold and operate their franchises invested in them. The Electrical Development Co. made an agreement with the commissioners of the Queen Victoria, Niagara Falls Park, and raised $10,000,000 on debentures to build a permanent plant and a transmission line from the Falls to Toronto. This claim was made in the writ issued by Mr. James Pearson, of Pearson & Denton. Another writ was issued in behalf of Walter D. Beardmore by Messrs. O'Brien & Lundy. The commission have had a great deal of trouble over the transmission line, but it is expected that the construction of the power line

will now be gone ahead with until it is completed. The tenders for the equipment of this line will, it is understood, be divided between the Canadian General Electric Co., Peterboro, and the Canadian Westinghouse Co., Hamilton. The engineers are making visits to these two companies before selecting the apparatus and the selection will depend upon their visit.

It will take the iron manufacturers at least eight weeks to make and deliver the material so that the work of construction will be commenced early in the spring.

Arrangements are now being completed for the amalgamation of the Toronto Electric Light Co. and Toronto Power Co. While this has not been brought about by the building of a Government transmission line, it has no doubt been hastened by it. The transmitting of electricity and selling at a definite fixed rate is not satisfactory to either the generating company or the consumer. Conditions vary and with a fixed rate neither company is on an equitable basis. The details of this amalgamation have not yet been decided upon, but Mr. William McKenzie and Sir Henry Pellat have successfully engineered an agreement. This includes an interchange of stock and puts the Toronto Electric Light Co. in the control of the Toronto Power Co.

On July 31, 1889, an agreement was signed whereby the Toronto Electric Light Co. could be purchased by the City of Toronto. Mayor Oliver intimates that the franchise expires in eleven years and that by giving one year's notice the city has the right-of-way. He intimates that it is the city's intention to take advantage of this clause in the agreement.

Mr. K. L. Aitkins, the city's electrical engineer, has decided to give notice to the Hydro-Electric Power Commission that the city will take the minimum amount of power. The city has contracted to take a minimum of 10,000 horse-power, but by giving notice of the intention before July 1, 1909, may only take and pay for a minimum of 6,000 horse-power. If more is used, of course, the city will have to pay for it. The city can use this amount itself, and while it may dispose of more, notice is merely given as a precaution in the event of there not being a market for more than 6,000 when the plant commences to operate.

### The Situation in London.

The City of London have decided by vote of the council to accept the commission's proposition and thus take a step towards quashing the injunction which have been issued against the commission in London. The council passed a resolution requesting the Government to pass such legislation as would validate present contracts which are being bought by the issue of injunction.

The city council of Windsor has decided to submit the question of taking power from Niagara to the ratepayers at the municipal elections in January.

### Situation in Brantford.

The Cataract Power Co. has made several offers to this city, but the citizens' and aldermanic power committee, at a joint meeting decided to recommend the closing of a contract with the Hydro-Electric Power Commission. The Council has been requested to submit the question to a vote of the people, if necessary.

---

## DEVELOPMENT.

Everything in this world is a development. Nothing happens by chance.

Everything and every idea is possible only because other things and other ideas have preceded it.

We look at a modern steam-engine and it seems very simple. The engine of fifty years ago was a little more complex and slightly more crude. We wonder why just as simple and just as good an engine was not made half a century ago—since the principle has not changed a particle.

Simply because fifty years ago they didn't have the tools, the materials, or the processes.

The farther you look back into the history of industry, the more you will be impressed with the fact that almost everything has improved as rapidly as our ability to produce it has increased.

As steel has improved in quality, and as machines to handle it have increased in capacity and accuracy, just so rapidly has the steam-engine been improved.

As men learned to roll heavier and heavier rails, so the size and power and speed of locomotives increased.

Just as men learned to build larger and more accurate boring-machines so has the size of big guns gone up, and the increasing ability to produce thicker and harder armor-plate has made possible the constant growth in the size of battleships.

The wonderful newspaper printing-presses were an impossibility until papier-mache stereotyping became a practical thing, and until paper-makers learned to make a strip of paper miles long.

But the web of paper was out of the question until the making of wood-pulp paper had been perfected.

And coming back to the original idea of the tool's part, the modern high-speed printing press would have been an impossibility, even with stereotype plates and endless paper, if machine-tools had not been so perfected that the minutest accuracy in gears and rollers became possible.

Wireless telegraphy would never have come about had not the other kind preceded, and it is impossible to imagine the phonograph's being ahead of the telephone.

Without illuminating gas and gasoline, Welsbach lights would never have been thought of or possible.

We would have no electric lights without the dynamo, and no dynamo if wire-drawing had not first been perfected.

So it goes—everything is dependent on factors that have preceded, and any achievement of to-day is the result of thousands of years of previous effort and thought.

There are no sudden jumps—no leaps and bounds. Upon analysis it will be found that progress is a slow growth.

And the knowledge that we are adding to the world's store to-day is but the foundation for further advance by men to come.—Silent Partner.

---

## REPLIES TO CORRESPONDENTS.

Editor The Power House,—I read Mr. T. E. Boyce's letter in your November issue and feel sure there must be some other cause for the fire than that stated in the letter. The idea of a short circuit occurred to me, but that, in my opinion, would not be the cause. Neither could the voltage have gone up suddenly or the fuse would have been burnt out. The dent in the lamp would be caused by the exterior heat, but there could not be a hole in the globe or it would not give light.

If the towel had been very dry and of some very inflammable material it would be easier to explain the cause.

Yours very truly,
INSURANCE.

---

Editor The Power House:

Will you kindly give me some formula to determine the size of chimney to use in connection with a battery of boilers?

Yours truly,
C.F.D.

A common rule for chimney area is to make it equal to one-tenth of the area of the total grate surface or to allow 2 square inches for every pound of coal burned per hour. A closer result will be obtained from the following formulae:

$$h = \frac{120 \times F^2}{t \times G^2}; \qquad A = \frac{0.06F}{\sqrt{h}}$$

where

A=area of chimney in square feet;
h=height in feet;
F=total number of pounds of coal burned per hour;
t=temperature of discharge gases at foot of chimney in degrees F;
G=total grate area in square feet.

—Editor Power House.

# The Westinghouse New Model Roney Mechanical Stoker

## Fundamental Principles Involved in the Design of a Good Stoker—Test and Description of New Roney Stoker, Pointing Out Special Features.

One of the problems before engineers at the present time is that of obtaining large evaporative capacity with sustained efficiency and smokeless operation. Owing to the extreme difficulty of getting firemen to stoke in the manner required to secure the desired results, it has been quite generally agreed upon by engineers that the mechanical stoker furnishes a simple means of maintaining the conditions necessary for the smokeless combustion, especially of long flaming bituminous coals. These conditions are especially difficult to realize, except by mechanical means under the heavy demands encountered in the modern boiler plant, which often require steaming rates of 50 to 100 per cent. above rating for long periods. The essential

Fig. 1.—Westinghouse Roney Stoker and Grates.

requirements for perfect smokeless combustion are:

1. That the fuel be fed continuously to the furnace in small quantities in order that the volatile gases may be driven off at a uniform rate.

2. That these volatile gases shall be mixed with sufficient air and maintained at a high temperature.

3. A sufficient distance must be provided between the fuel bed and the heating surface of the boiler in order that the volatile gases will have time to be completely consumed before being chilled by contact with the comparatively cool surfaces of the boiler.

4. A suitable grate with liberal air passages for consuming the fixed carbon remaining after the coking process.

5. Some means of continuously agitating the fuel so as to bring all the particles of carbon in intimate contact with the air supply.

6. From a mechanical standpoint, the grate bar should have a large ratio of cooling to heating surface to permit higher rates of combustion, at the same time insuring a long life.

In addition to the above, to permit high rates of combustion with moderate draft pressures, the following are also necessary:

7. An automatic means of agitating and advancing the fuel bed at the proper rate of combustion to suit the load carried.

8. Adjustable area for admission of air through the grate, increasing with the rate of combustion so as to avoid excessive pressure drop through the grates and the fuel bed.

Reviewing briefly the general type, it will be seen that the coal is fed into a hopper extending across the boiler front, usually by gravity from an overhead bin. From this hopper the fuel is automatically supplied to the furnace by a reciprocating pusher operated from the rock shaft by an eccentric. The fuel descends through the throat of the arch on to the upper grate bars where it is subjected to an intense heat radiated from the incandescent fire-brick arch spanning the upper portion of the furnace. This entirely cokes the fuel and drives off all the volatile gases, leaving the coke, or fixed carbon, which is then gradually worked down the inclined surface by the rocking motion of the grate bars, imparted to them from the eccentric on the rock shaft.

The oscillation of the grate bars not only work the fuel slowly down the furnace, but also keeps it constantly agitated, this preventing to a large extent the formation of clinker and bringing the fuel into intimate contact with the incoming air. After the solid combustibles have been totally consumed, the remaining ash is discharged on to the dumping grate at the bottom of the furnace.

### Sectional Grate Bars.

One of the most important features of the New Model Roney Stoker, is the sectional grate bar, or fire-top, illustrated herewith, Fig. 1. For the upper four grates, a non-sifting type top is used, provided with abutting horizontal ledges to prevent the fine fuel from sifting through the bars, and at the same time permitting a free entrance of air. As only the thin edge of the fire top is exposed to the direct heat of the fire, while both sides and bottom edges are cooled by the incoming air, these tops are well protected from over-heating. For each square foot exposed to the fire, 7.4 sq. ft. of surface is cooled by the air, giving 7.4 times the cooling effect of the flat top grate bar.

As will be seen from Fig. 2, the grate proper consists of a number of thin plates set on edge in V-grooves. These hook over a trussed web, and are held in place by a key-rod slipped in from the end. They are, therefore, easily removed. The webs have conical bearing surfaces at the end, which makes them self-centering in the side bearers and prevents any uneven wear. By lifting the webs out of the bearers and removing the key-rod, the tops may be redis-

tributed, if desired, so as to equalize the wear in various parts of the furnace.

The eight samples referred to in the table were selected from different parts of a furnace below the arch line after seven months' service. The accompanying table shows that the maximum annual depreciation is found to be 66 per cent., indicating a minimum life of one and a half years:

**Record of Seven Months' Wear.**

Type "D" sectional grate bar top.

| Sample No. | Weight | *Reduction in weight. | Per cent. in burning surface. | Annual depreciation, per cent. | Approximate life years. |
|---|---|---|---|---|---|
| 1 | 2.375 | 17.4 | 38.7 | 66.3 | 1.51 |
| 2 | 2.625 | 8.7 | 23.7 | 40.6 | 2.46 |
| 3 | 2.625 | 8.7 | 16.7 | 28.6 | 3.49 |
| 4 | 2.75 | 4.3 | 11.3 | 19.4 | 5.16 |
| 5 | 2.562 | 10.9 | 10.0 | 17.1 | 5.83 |
| 6 | 2.69 | 6.4 | 7.4 | 12.7 | 7.88 |
| 7 | 2.562 | 10.9 | 4.8 | 8.2 | 12.1 |
| 8 | 2.812 | 2.1 | 3.2 | 5.5 | 18.2 |

*Weight of original top, 2.875 lbs.

An average annual depreciation of about 17 per cent. is shown by these eight samples, indicating a probable life of about six years if the bars are redistributed from time to time. In the upper part of the furnace, however, the wear was practically nil. It should be noted that the boiler from which the samples were taken, was subjected to unusually severe conditions, having been operated above rating practically continuously, and at times forced to 100 per cent. above its rated capacity.

One of the principal advantages of the sectional grate bar tops, is that it reduces the amount of scrap when they have been sufficiently worn to be discarded. In this stoker, all internal parts are made interchangeable. No bolts are used, and any part can be removed without disturbing the other.

**Guards and Dumping Grates.**

The new type of guard prevents the fire from sliding into the ash pit when the dumping grate is operated. As the lower end of the guard is now raised, instead of cutting through the fire, as formerly, it not only makes it possible to dislodge from the fire all clinker formed at the bottom, but also provides an unobstructed descent for the ash and clinker separately. When dropped into its normal position, it permits the lower edge of the fire to settle quietly without tendency to slide.

The new dumping grate is hinged about one-third forward, dumping both front and rear. Being nearly balanced, it is very easily operated. The upward motion of the dumping grate breaks up any clinker bridge tending to form between the grates and bridge wall. Both the dumping guard and grates rest in U-shaped trunions in the side bearers, the guard being simply hooked over the bearing rods shown in Fig. 2. The latter can, therefore, be removed without dismantling any portion of the stoker.

The rocking motion is transmitted to the grate bars by means of a connecting rod from the eccentric "agitator." As the grate bar tops are unbalanced, they return to the inclined position by their own weight, and, therefore, only one feed adjustment is necessary, made by the sheath nut on the end of the connecting rod. As motion has to be transmitted to the connecting rod in one direction only by the "agitator," a simple locking device, or dog, is used for holding the grates open to permit rapid trimming of the fires.

**Air Distribution.**

The most essential requirements for smokeless combustion, are a gradual coking of the green fuel and an adequate supply of pre-heated air admitted above the coking bed. These conditions have received special attention in the design of the New Model Roney Stoker. The air supply to affect the combustion of volatile hydro-carbons, is admitted through two wind-gates located on either side of the stoker. It first passes to the rear of the fire-brick arch, extending across the front of the furnace, and is then directed by baffles to the crown of the arch, at which point it enters the front air space. From the latter, it enters the furnace through the spaces between the stoker front and the first ring of arch brick. Passing the air over the furnace in this manner, not only pre-heats the air, but assists materially in cooling the arch.

The fire-brick arch is of such extent and so designed that it completely cokes the green fuel and directs the gases downward over the hottest part of the fire, therefore, permitting the volatile gases to be completely consumed before coming in contact with any of the boiler heating surfaces.

**Combustion.**

With the gates open maximum width, the effective admission area of the entire gate is 36.9 per cent. of the projected area of the furnace. At maximum opening, i.e., in their lower position, the effective opening is 24.2. Taking actual time of opening and closing, the average effective draft area of this type of stoker is 27.4 per cent. of the total projected area. This admission area makes it possible to maintain a high rate of combustion. This has been very effectively brought out by a series of capacity tests conducted upon a 375 h.p., B. & W. stoker-fired boiler at East Pittsburg. During these tests, an output of over double rating, 224.7 per cent., was maintained for six hours, with 0.42 in. furnace draft. This corresponds to a rate of combustion of 46 lbs. per sq. ft. per hour, with a very reasonable over-all efficiency of 63.5 per cent. at this load. A test of 25 per cent. above rating was maintained for six hours with 0.18 in. draft, with 74 per cent. efficiency and 23 lbs. of coal per sq. ft. of grate per hour. The fact that the boiler and grate passed through this severe test without damage, while the brick setting was melted down, illustrates the effectiveness of the improved air distribution through the grates, and also the fact that a somewhat higher rate of combustion may be normally maintained with the same efficiency, or, in other words, a higher output per boiler unit.

These stokers are manufactured by the Westinghouse Co., Pittsburg.

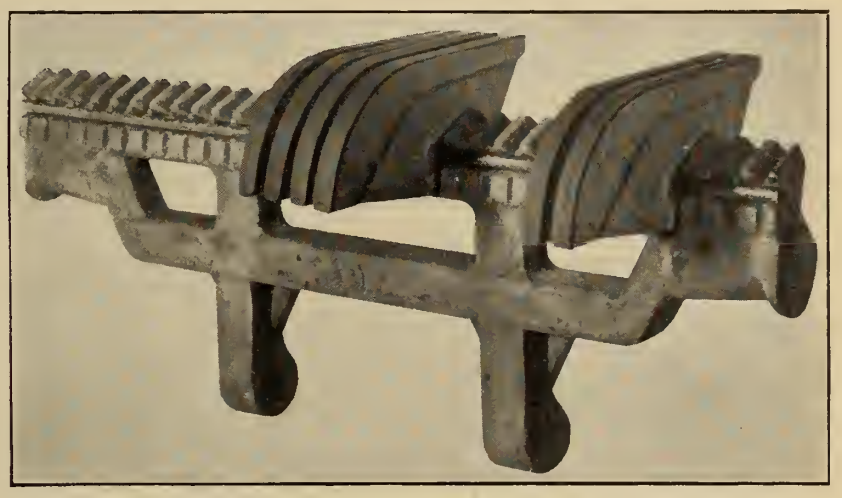


Fig. 2.—Roney Grate Construction, Showing Key-Rod.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

### HORSE POWER OF SHAFTING.

**As Main Shafting Carrying Gearing.**

H.P.=horse power. D=Diameter of shaft in inches. R=Revolution of shaft per minute.

$$\text{Formula—H.P.} = \frac{D^3 \times R}{125}$$

Example: Find the h.p. of a 4-inch diameter shaft when running at a speed of 150 r.p.m.

$$\text{H.P.} = \frac{4 \times 4 \times 4 \times 150}{125} = 76.8 \text{ horse power.}$$

**As Second Motion or Line Shafting.**

$$\text{Formula H.P.} = \frac{D^3 \times R}{90}$$

Example: Find the h.p. of a 4-inch diameter shaft running at a speed of 150 r.p.m.

$$\text{H.P.} = \frac{4 \times 4 \times 150}{90} = 106.6 \text{ horse power.}$$

**For Simply Transmitting Power.**

$$\text{Formula—H.P.} = \frac{D^3 \times R}{50}$$

Example. Find h.p. of a 4-inch diameter shaft when running at a speed of 150 r.p.m.

$$\text{H.P.} = \frac{4 \times 4 \times 4 \times 150}{50} = 192 \text{ horse power}$$

---

### CHANGES FOR A BETTER SERVICE.

By J. A. C.

Our new master-mechanic who, by the way, was an ex-marine engineer, clearly demonstrated that it paid well to get ready before starting any particular job. Up to the time of his coming all boilers installed had been moved from the unloading point to the boiler houses by means of planking, rollers, etc.; but when he had three firebox boilers to instal at the top of a steep hill about 400 yards long, he got the following outfit ready before attempting the job. A heavy truck was made out of 4" pipes for axles, heavy wooden wheels about 2 ft. in diameter and 1 ft. thick, strapped with iron bands, and the two axles joined by timbers. This truck was used to carry the boilers (one at a time, of course) and a block and tackle consisting of a steel wire cable and three 3 ft. rope sheave wheels was used to do the hauling. The three sheave wheels were used as a single and a double block, as the common blocks were so small they would kink the cable and greatly increase the pulley friction. The fall of the tackle, i.e., the free or pulling end of the cable in the blocks, was taken up the hill and wound in on a steam winch. Of course the cable was not long enough to do the job at one lift and so the single block was snubbed to a tree at the top of the hill, the tackle stretched down hill as far as possible, and the balance of the distance covered by the cable attached to boiler truck. This truck cable was of course attached to the double block, and as each lift was completed, bringing the blocks together, the truck was blocked and the tackle stretched down hill for another lift. An amusing incident happened during this work. There were some green hands on the job and the master mechanic had to watch them closely at first to see that they snubbed the single block and used the double one as the moving block so as to get a little better advantage on the pull. When one of the boilers was almost in place on the foundation it became necessary to snub the double block to an engine or fan shaft

### HORSE POWER OF LEATHER BELTS—Per inch of width.

| Velocity of Belt in Feet per minute. | Best oak-tanned Belts. | | | Best Link or Chain Belts. | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Single Belts. | Light Double Belts. | Heavy Double Belts. | in. ⅜ | in. ½ | in. ⅝ | in. ¾ | in. ⅞ | in. 1 |
| 100 | 0·15 | 0·21 | 0·27 | 0·13 | 0·15 | 0·17 | 0·20 | 0·24 | 0·27 |
| 200 | 0·30 | 0·42 | 0·55 | 0·25 | 0·29 | 0·35 | 0·40 | 0·47 | 0·55 |
| 300 | 0·45 | 0·64 | 0·82 | 0·38 | 0·44 | 0·52 | 0·60 | 0·71 | 0·82 |
| 400 | 0·61 | 0·85 | 1·09 | 0·51 | 0·58 | 0·69 | 0·80 | 0·95 | 1·09 |
| 500 | 0·76 | 1·06 | 1·36 | 0·64 | 0·73 | 0·86 | 1·00 | 1·18 | 1·36 |
| 600 | 0·91 | 1·27 | 1·64 | 0·76 | 0·87 | 1·04 | 1·20 | 1·42 | 1·64 |
| 700 | 1·06 | 1·49 | 1·91 | 0·89 | 1·02 | 1·21 | 1·40 | 1·65 | 1·91 |
| 800 | 1·21 | 1·70 | 2·18 | 0·92 | 1·16 | 1·38 | 1·60 | 1·89 | 2·18 |
| 900 | 1·36 | 1·91 | 2·45 | 1·05 | 1·31 | 1·55 | 1·80 | 2·13 | 2·45 |
| 1000 | 1·51 | 2·12 | 2·73 | 1·27 | 1·45 | 1·73 | 2·00 | 2·36 | 2·73 |
| 1100 | 1·67 | 2·33 | 3·00 | 1·40 | 1·60 | 1·90 | 2·20 | 2·60 | 3·00 |
| 1200 | 1·82 | 2·55 | 3·27 | 1·53 | 1·75 | 2·07 | 2·40 | 2·84 | 3·27 |
| 1300 | 1·97 | 2·76 | 3·55 | 1·65 | 1·89 | 2·25 | 2·60 | 3·07 | 3·55 |
| 1400 | 2·12 | 2·97 | 3·82 | 1·78 | 2·04 | 2·42 | 2·80 | 3·31 | 3·82 |
| 1500 | 2·27 | 3·12 | 4·09 | 1·91 | 2·18 | 2·59 | 3·00 | 3·55 | 4·09 |
| 1600 | 2·42 | 3·39 | 4·36 | 2·04 | 2·33 | 2·76 | 3·20 | 3·78 | 4·36 |
| 1700 | 2·58 | 3·61 | 4·64 | 2·16 | 2·47 | 2·94 | 3·40 | 4·02 | 4·64 |
| 1800 | 2·73 | 3·82 | 4·91 | 2·29 | 2·62 | 3·11 | 3·60 | 4·25 | 4.91 |
| 1900 | 2·88 | 4·03 | 5·18 | 2·42 | 2·76 | 3·28 | 3·80 | 4·49 | 5·18 |
| 2000 | 3·03 | 4·24 | 5·45 | 2·55 | 2·91 | 3·45 | 4·00 | 4·73 | 5·45 |
| 2100 | 3·18 | 4·45 | 5·73 | 2·67 | 3·05 | 3·63 | 4·20 | 4·96 | 5·73 |
| 2200 | 3·33 | 4·67 | 6·00 | 2·80 | 3·20 | 3·80 | 4·40 | 5·20 | 6·00 |
| 2300 | 3·49 | 4·88 | 6·27 | 2·93 | 3·35 | 3·97 | 4·60 | 5·44 | 6·27 |
| 2400 | 3·64 | 5·09 | 6·55 | 3·05 | 3·49 | 4·15 | 4·80 | 5·67 | 6·55 |
| 2500 | 3·79 | 5·30 | 6·82 | 3·18 | 3·64 | 4·32 | 5·00 | 5·91 | 5·82 |
| 2600 | 3·94 | 5·52 | 7·09 | 3·24 | 3·78 | 4·49 | 5·20 | 6·15 | 7·09 |
| 2700 | 4·09 | 5·73 | 7·36 | 3·28 | 3·85 | 4·66 | 5·40 | 6·38 | 7·36 |
| 2800 | 4·24 | 5·94 | 7·64 | 3·31 | 3·86 | 4·73 | 5·60 | 6·62 | 7·64 |
| 2900 | 4·39 | 6·15 | 7·91 | 3·32 | 3·87 | 4·78 | 5·80 | 6·85 | 7·91 |
| 3000 | 4·50 | 6·36 | 8·18 | 3·31 | 3·86 | 4·75 | 5·97 | 7·09 | 8·18 |
| 3100 | 4·60 | 6·58 | 8·45 | 3·30 | 3·85 | 4·73 | 5·96 | 7·33 | 8·45 |
| 3200 | 4·69 | 6·79 | 8·70 | 3·28 | 3·82 | 4·71 | 5·94 | 7·37 | 8·73 |
| 3300 | 4·77 | 7·00 | 8·86 | 3·24 | 3·77 | 4·70 | 5·92 | 7·35 | 8·88 |
| 3400 | 4·84 | 7·21 | 8·96 | 3·19 | 3·71 | 4·64 | 5·87 | 7·32 | 8·86 |
| 3500 | 4·90 | 7·31 | 9·06 | 3·13 | 3·61 | 4·50 | 5·78 | 7·26 | 8·80 |
| 3600 | 4·95 | 7·40 | 9·16 | 3·05 | 3·50 | 4·37 | 5·67 | 7·16 | 8·73 |
| 3700 | 4·99 | 7·48 | 9·24 | 2·96 | 3·39 | 4·26 | 5·55 | 7·01 | 8·58 |
| 3800 | 5·03 | 7·54 | 9·29 | 2·84 | 3·28 | 4·15 | 5·41 | 6·87 | 8·41 |
| 3900 | 5·06 | 7·60 | 9·34 | 2·72 | 3·13 | 4·02 | 5·20 | 6·70 | 8·27 |
| 4000 | 5·08 | 7·64 | 9·37 | 2·58 | 2·95 | 3·84 | 5·01 | 6·48 | 8·04 |
| 4200 | 5·10 | 7·70 | 9·38 | 2·27 | 2·55 | 3·37 | 4·52 | 5·98 | 7·51 |
| 4500 | 5·07 | 7·69 | 9·27 | 1·64 | 1·77 | 2·45 | 3·68 | 5·05 | 6·55 |
| 5000 | 4·82 | 7·42 | 8·75 | 0·42 | 0·15 | 0·61 | 1·55 | 2·78 | 4·32 |

and use the single one as the mover, attached to the boiler truck. When one of the block and tackle pupils saw the state of affairs he rushed to the master mechanic and warned him not to try that pull as he knew the engine and fan foundation would be pulled out because it was always the double block that moved.

The compressed air supply to the machine and blacksmith shops had to be taken across several car tracks and the former method was simply a case of running the pipe underground, under the tracks, then up into the shops. This made a pocket in the line, with the result that the air froze up every cold spell. Our new master mechanic got over this by placing the pipe overhead of the tracks. As no posts could be put in he trussed the span with iron rods and pipe clamps and thus made the pipe self-supporting. Since the change was made the air has never frozen up.

## STEAM TRAP INSTALATIONS.

By. H. L. Peiler.*

The facilities which modern methods of transportation afford for the cheap and ready distribution of commodities have resulted in a much keener competition among manufacturers, and whereas even fifty years ago each producer provided for the requirements of the circle of smaller towns or cities in his immediate neighborhood only, and left the more distant field to the manufacturer of a similar line of goods in that district, it now happens that every prominent factory has a radius of business influence that is only bounded by tariff walls, and even these with their well-defined difficulties are not always proof against cheap carriage, especially so long as ocean and water transportation cost so much less than the overland railway haul.

It is largely to this influence that the keen competition of the present time is due, and that the selling price of most articles is kept at so low a level that increased profits can only be shown by constantly decreasing manufacturing cost. The result is that the modern producer devotes much more study to the reduction of expenses of every kind, and as the cost of fuel and of the general operation of power plants is one of the most vital questions, this end of the business receives quite as much attention as the question of labor-saving machinery. Suction-gas and electric power plants give greater economy than steam in many small plants where conditions for their use are favorable. But this is very frequently not the case, and it will be a long time before the steam plant is obsolete, and particularly in all those manifold industries where heat and moisture are required, and. moreover, general climatic conditions in the northern half of this continent are of such a nature as to necessitate the use of steam even where the actual motive power is taken from other sources.

In consequence of the early recognition of the waste of fuel due to imperfect combustion, the study of this subject has resulted in improved boilers, with their accessories of better proportioned grates surface, draft and heating surface, in the invention of mechanical stokers, damper and feed water regulators, of super-heaters and economizers, and many other devices all tending to the more complete utilization of the heat units produced by the combustion of fuel.

As the study of these various economies progressed, the attention of engineers was further directed to the waste steam occurring from the loss of the hot water of condensation, where steam-using machinery was being operated, and various methods were devised of saving and using over again, the hot distilled water drawn from driers, heating and boiling apparatus of all kinds, and the drips from steam mains and all those manifold and sundry places in the average steam plant where condensation forms and reduces the efficiency of steam.

Many owners of plants would be surprised to know to what a sum this saving amounts annually. Two recent tests in Montreal plants show that where steam is used for heating alone, the direct loss amounted to almost 60 per cent. of the fuel burned. Case I., a large newspaper plant running 24 hours per day, general printing by day, newspaper printing by night. showed a daily fuel consumption of 2½ net tons of coal per diem, while the condensation was run to waste. The returning of the hot water to the boilers cut down the fuel to a trifle over one ton per day. Case II., also a printing and lithographing establishment, showed a reduction from nearly two tons daily to three-quarters of a ton under similar conditions.

As a general proposition it may be safely stated that the saving of fuel in the average steam plant resulting from the return of condensation to the boilers will seldom go below 10 per cent. of the total fuel used, and will frequently run as high as 40 per cent., according to the temperature at which the hot water can be returned to the boiler-rooms and re-conveyed into the boilers themselves.

The commonest method in use in Canadian engineering practice has been to bring all drips to a common receiver or hot-well, and to pump the hot water back into the boilers from that point. This system works satisfactorily where the returns are not above the boiling point, and in high-pressure heating systems these returns are usually sent to an open or vented receiver, where by expansion the water cools to the boiling point or lower, so that it can be pumped without affecting the operation of the pump. In such case, the exhaust from the pump is utilized in the feed-water heater. It is important to note that, where the initial pressure in a heating system is from 60 to 80 lbs., as is frequently the case in dry room work and other special cases where higher temperatures are required, the temperature of the condensation will be usually very much above the boiling point. Hot water at a pressure of 50 lbs has practically the same temperature as steam under equal pressure, namely, 298 degrees F., and if this can be returned to the boilers without loss of these heat units, the fuel saving will be naturally equal to the amount of coal required to heat this water from 212 degrees to 298 degrees.

An interesting problem was recently presented to the writer in the engine-room of a large textile mill in Montreal. It was required to drain the steam-bender, the steam separator in main steam line to the engines, the steam main to the pumps and also the coils in the exhaust, re-heater, and to return these drips to the boilers. Boiler pressure is 180 lbs, and practically the same on the header and mains, there will naturally be a slight drop in pressure in the re-heater coils. It is probable that a gauge test would show a pressure at the receiver of not less than 160 to 165 lbs. Each separate drip is trapped and the high-pressure Bundy separating traps discharge to a closed receiver where the water under pressure is taken to a Bundy return trap on the boilers and discharged into these without loss of temperature. It is probable that under the conditions the water from these drips will be put into the boilers at a temperature of about 350 degrees F., and consequently so hot that if exposed to the atmosphere it would largely expand into steam. I doubt if any pump could operate on water at this high temperature. The general heating system of this mill is low-pressure and drains to a receiver, whence it is pumped to the boiler-room hot-well. The drip from the engine-room might have been treated in like manner, but the heating system is only operated in cold weather. The system which is being installed is entirely automatic, works only when there is water to be handled, drains perfectly all the condensation formed as rapidly as this gathers, has minimum running cost owing to the saving of oil, packing and incidental pump expenses, and uses for

* Of Peiler & McKenzie, Montreal, Canadian agents for the Bundy trap.

its actual operation about one-thirtieth of the amount of steam of a pump of equal capacity.

Another feature of the condensation problem that is of greater interest to engineers and owners of plants, is that of the efficiency of steam-using machinery, such as dry-rooms, kettles and such other apparatus where all the available heat of the steam should be utilized.

It is an established fact that steam loses heat in the process of condensation. If water remains in the pipes it hastens condensation, and there is a marked difference in efficiency between apparatus from which the water is merely removed and that from which it is removed promptly. The purpose of a steam trap is to hold the steam at the point where it is needed and to allow the water to drain quickly away. Almost numberless devices have been made for this purpose, but most of these fail in the second purpose and they frequently decrease the efficiency of the apparatus to a marked extent by the very fact that they do not remove the water as fast as it forms. It is not uncommon to find engineers of large experience declaiming against the steam-trap in general because of the difficulty of obtaining a trap that fulfills both requirements continuously in actual operation. The writer knows of instances where apparatus is, owing to the prejudicial experience of the engineer in charge, operated under the old method of having a man turn on a valve to let the water out and closing it when the steam escapes. This model is ideal if the man could always see the water and close off his valve just before the steam comes, but is naturally wasteful in practice. However, there are separating traps that make this identical operation accurately. It is simply an automatic valve actuated by the weight of the water accumulating, not in the pipe or apparatus to be drained, but in the bowl of the trap. When the water accumulates in the bowl the latter drops, opens a valve, discharges its load of water, and when it has relieved itself the bowl is raised by a counter-weight and the valve automatically closed before any steam can escape. The results shown are remarkable. At a working test made in the laundry of the Standard Shirt Company, in Montreal, on a drying room, it was found that with a trap of the interior float type each drying occupied 40 minutes, while with a Bundy trap the same work was accomplished in 25 minutes. The whole laundry of this company was then equipped, and it was found that the new dry-rooms were actually able to do 50 per cent. more work than the makers' estimate and that the collar and shirt ironing machines gave just as proportionately increased results. This laundry does all the work for the Canadian Converters (four large factories) and employs 150 hands under normal conditions, and the whole instalation is operated, according to their superintendent, after tests made by their consulting engineers, with 45 h.p. steam for heating water, drying and ironing. Moreover, as steam is used at a pressure of 70 to 75 lbs., and as traps will raise water vertically two feet for each pound of pressure at the trap, there is no hidden piping, no tunnel, and no pipes either under or on the floor level. The traps discharge overhead, the return main resting on the same hanger as the steam main that feeds the machines, a feature that appeals to every practical engineer who has had to open floors and hunt for leaks in buried pipes.

---

## THE WATER COLUMN.

By W. H. McIntyre.

One of the most important things about a boiler is the water gauge and the water column to keep them clean from mud and scum.

The fireman in most power plants has his work cut out for him considering the disadvantages he has to put up with at times. He has his own life in his hands and perhaps many others around him, so it pays him to be well versed in the working of power house equipment. I have been in charge of a battery of boilers for some time and was troubled with the breaking of gauge glasses, one or two per week. Now I congratulate myself by not having one break in the last six months.

The cause of breaking was this: I did not use my scum valve enough to keep the scum from the water surface. Now I use the scum valve every day with good results. I find by doing this every day I save in labor and in gauge glasses and increase the safety of the boilers.

I would sooner scum a boiler down, or six of them, than put in a new water gauge glass. It is not the putting it in, but it is the job shutting off the steam. I have had my experience of that. There are other ways, too, of saving the gauge glass, that is by opening the blow-off valve on the water column very slowly till you get the column the same temperature as the water.

There are some points also about the feed water valve in opening and closing it. Open it slowly and shut it the same. There is much to learn about this. An experienced man can open and shut a valve and not injure it for a long time. A non-experienced man can close a valve so tight that he breaks or cracks the disc in closing it. The engineer or fireman must have a feeling for the seat of the valve which he will get only by experience. Then there will be no danger of closing the valve so tight as to break the disc.

---

## TROUBLES WITH RACING ENGINES.

By Canuck.

Some time ago I had trouble with a 12x12 automatic cut-off, slide-valve, balance type of engine. The engine was used for night work with a variable load of from 100 to 250 amperes. With a light load it would start to race. Without warning, up would go the voltage and burn out some incandescent lamps. With a fair load it was all right.

I put an indicator on it, but it showed me nothing. This was a new engine just out of the shop, so I sent for the maker to look it over, but he could find nothing wrong. I was getting disgusted with the engine so started at the engine, deciding to find the trouble if at all possible. I took off the valve cover, slackened the governor spring, set the valve at the shortest travel and then discovered the trouble. The valve was so short, it did not cover the parts by $\frac{1}{8}$ in. In took the valve out put $\frac{1}{4}$ in. on each end of the valve, put it back in place and it has worked splendidly ever since.

---

## REPAIRING DUPLEX STEAM PUMPS.

By John Thurlow.

Some time ago when I came to the plant I am now in charge of, I found a duplex steam pump which I was informed was no good. They were feeding with a double plunger, belt driven pump, but as I couldn't get any water in the boiler unless the engine was running, or the boiler pressure below city pressure, I resolved to see what was the matter with the pump.

I found the valves in very bad shape, so ordered new ones. I then packed the

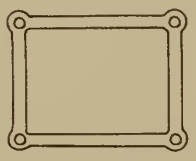


Fig. 1.

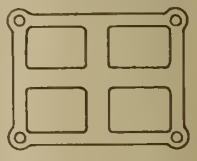


Fig. 2.

water plungers, and examined steam pistons and valve chest. I set out the piston rings some. I then reset the valves, put a lubricator on it and painted it up.

When the valves came I was connecting the pipes up and changing them somewhat, so my fireman put in the new valves. We got everything ready and turned on the steam. It run like a clock, but wouldn't force a pound of

water in the boiler nor out the discharge pipe.

I was puzzled, for I felt sure I had it in working shape after the thorough overhauling it had.

I looked at the plungers. They were alright. I took off the cap on the water end and found the top deck of valves were O.K., but on taking off the top deck I found that my fireman had cut the packing wrong, and the water was simply being passed from one side to the other.

Fig. 1 is the way he put the packing in, when he should have cut it same as Fig. 2. The four openings, Fig. 2, are the port holes which allow the water to pass from bottom chamber to top one.

When we made the change all was in running order and our trouble was over.

Another time last year I was called up one night to our sand, lime, brick plant. The day's make of bricks are baked by steam pressure in a steel cylinder 62 ft. long by 6 ft. in diameter, made of ¾" plate, with butt joints and carry 125 lbs. pressure for 10 hours every night. It is very important that the steam pressure be kept even all the time, so as to bake the bricks properly.

When I got there, the night fireman (who had 10 years' experience) had the fire drawn, the water almost to the bottom of the glass, the pump stopped and the cap off the water end. The cap on water end was held down by 4 ⅞" bolts screwed into the body of pump, with nuts on top of cap in the usual way. One of the bolts had broken, hence the shut down.

I sized up the situation, got the piece of bolt out of body and turned bolt end for end, screwed it in as far as I could spare, put on cap and still had a full nut, as both were somewhat long. In 15 minutes we had her running and it finished the night all right. Next day at noon hour we took cap and top deck off, bored bolt holes larger, then tapped out the bottom holes to ½" and threaded them. We put in a new set of ½" bolts and have had no more trouble.

---

## EMERGENCY REPAIRS.

The accompanying sketches show some methods adopted of effecting repairs where time was limited and only a small supply of tools available. In each case the work lasted until new parts could be fitted.

Fig. 1 is a length of tunnel shafting 11 in. in diameter, in which a crack A B some 18 in. in length developed while the ship was encountering heavy head seas and the engines racing badly. It was discovered by one of the engineers, who noticed that the shaft was running out of truth. The engines were slowed down, and the crack could then be detected. Later on, when the engines were stopped, it was seen to be open ⅛ in. on one side and 1-16 in. on the other. The chief engineer decided to clamp the shaft as well as possible, and for this purpose the deck booms were stripped of their clamps, but when tried were not strong enough to draw the shaft together. It then occurred to the chief that an excellent clamp could be made from the spare propeller nut, and this was done.

The nut was put in one of the furnaces and heated to a white heat, and

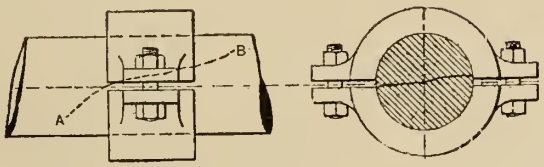



Fig. 1.—Tunnel Shafting.

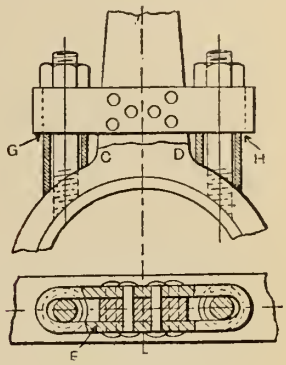



Fig. 2.—Eccentric Rod.

with an ordinary hatchet and a flogging hammer was split down through the lugs, making the two halves of a clamp with 3 in. metal. Another heat was necessary to open out the split nut to the same size of the shaft, this being done by hammering each half on the tunnel shaft while hot. Two 1½ in. holes were drilled in each half of clamp, a ¾ in. drill being put through first, and afterwards a bar and cutter made to fit the ratchet. Two bolts were made from 1½ in. steel, screwed at each end, and on putting the clamp on the shaft and tightening the nuts, the crack closed up, enabling the ship to steam at the rate of 6 knots to her destination.

Fig. 2 shows how the broken eccentric rod of a donkey pump was repaired. The strap and rod were of brass cast in one piece. The donkey, which was used for turning the main engines, had a grooved rope pulley keyed on the shaft next to the eccentric, and it was whilst turning that the rope came off, causing the breakage of the rod at C D.

A piece of 1 by ¼ in. iron was bent round as at E, and the ends welded; it was then rivited to the eccentric rod close to the break. Two studs were screwed into the strap, and two thimble-pieces, made from a piece of piping, to suit the radius of the strap at the bottom, and flat on the top. They were made of such a length that when the strap and rod were brought together there was 1-16 in. clearance at G and H before the nuts were tightened. This clearance was taken up when the nuts were screwed down, allowing the two parts to be firmly pressed together at the break. This repair has now been running for some time, and holds as well as the original rod did.

Fig. 3 shows a repair to a broken feed-pipe. A piece of soft wood was bored out so as to be a tight fit on the feed-pipe, and also made a good fit in a piece of boiler tube 9 or 10 in. long. Two glands as shown in Fig. 4 were made from ½ in. iron plate. K is a washer riveted on to the plate, its outside diameter fitting into the ends of boiler tube. In fitting together, one of the glands was first put on each broken half of the pipe by springing the break apart. The boiler tube with the wood in the centre of its length was also put on one end and pushed along far enough for the broken ends to be broken together. The tube was then brought back so that the wood rested half on each side of the break, the ends packed with Tuck's packing as shown at T, an equal amount being put in each end to keep the wood central. The two glands were then brought up against the packing and

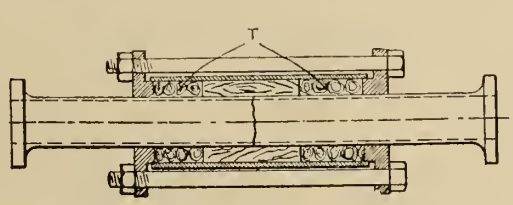



Fig. 3.—Repairing Broken Feed Pipe.

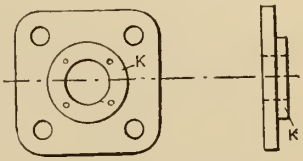



Fig. 4.—Glands.

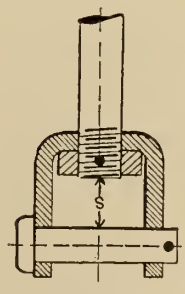



Fig. 5.

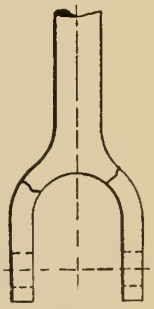


Fig. 6.

screwed up hard with bolts passed through the holes drilled in each corner. It should be mentioned that the distance between the two flanges was not more than 3 ft. while the pipe was securely anchored, so that there was little fear of the broken ends being blown out. After the water had been passing a little while there was hardly a weep from the break.

Fig. 5 shows a broken valve spindle of a winch, and Fig. 6 shows how it was repaired. The end of the spindle was filed round and screwed ⅞ in. Whitworth. A piece of ⅜ by 1½ in. steel was bent in the shape of a U, and drilled and tapped ⅞ in. to fit tightly on the end of the spindle. After screwing the spindle through the fork, a nut was put on to lock it, and a hole drilled for a ⅛ in. split pin through the nut and spindle as an additional security. The fork was made longer than the original one to compensate for the amount the spindle protrudes through the fork. The distance S was made equal to the thickness of the quadrant and block plus a working clearance, say ⅛ in.

The valve of course had to be set afresh for both ahead and astern, being moved by the nuts on the spindle to give the required lead. In a case where a spindle moved a valve by means of a hoop, it would be necessary to make the new fork end the correct length. This could be done by putting the broken parts together, popping the spindle, and setting the dividers from pop to the centre of the pin. It would also be necessary to have the distance S sufficient.

---

## ECONOMIES IN STEAM HEATING.

By Canuck.

For the benefit of others that may be interested in the utilizing of exhaust steam from steam hammers for heating purposes, I will relate what we did with this steam. The company by which I am employed, have a lot of heating to do and were short of exhaust steam. Even if they did have exhaust steam to spare they would have to carry it such a long distance that it would not be economical. I suggested, to overcome the difficulty, that they use the steam from the hammers and this they decided to do.

We use the Sturtevant system of heating. The blacksmith shop is 60 feet from the nearest heater. In the blacksmith shop are two steam-hammers, one at each end of the shops, one with a 4 in. exhaust and the other with a 3 in. I ran both exhausts into a 6 in. with a Y branch and carried the 6 in. to the heater with a relief valve outside, should there be any back pressure. With both hammers exhausting into the pipe at the same time there is only 1 lb. back pressure.

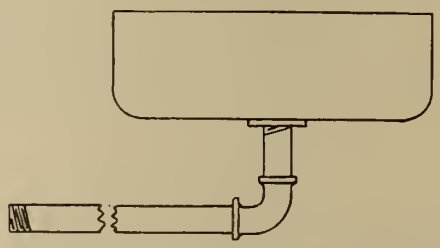
For the summer time I had a T put in the line with a plug in it. During the summer the plug was removed so that the steam was not forced through the relief valve.

---

## REPAIRING A BLISTERED BOILER.

A boiler in a factory was not properly washed out and the scale collected in it where the heat was intense and it blistered. When the boilermaker came to fix it he found the air pressure too low to run the air-drill, to drill the piece out so he accomplished it in this way.

He cut the end off an ordinary kitchen water heater, as shown in sketch, and in it built a fire with blacksmith's coal.



Outfit Used to Heat Blistered Part.

He attached the air hose to the one-inch pipe and made a hot fire beneath the blister. When it was red hot he chipped the blister out with a hammer and chisel. The patch was measured and drilled in the machine shop, and the holes in the boiler were drilled by a ratchet drill. The fire wall was given a greater slant to better distribute the heat before starting the boiler again.

---

## BOILER EXPERIENCES.

By Mac.

Someone, it may have been Solomon or it may have been Mark Twain, it is the truth, anyway, said that the cheapest kind of experience is other people's experience. So the following experience may help some one to avoid making a mistake and thereby get a little experience of his own which is the dearest kind of experience.

In a certain plant the boiler blow-off cocks leaked badly and the resulting steam was very objectionable in the boiler room, being so bad at times that it was very difficult to navigate. To get rid of the steam it was decided to instal a vent, connecting the draw into which the blow-off pipes discharged, with the atmospheric pipe over or above the atmospheric valve. (The engines were compound condensing). No doubt considerable steam found its way out this way, but it was never missed.

Trouble arose, however, in blowing down the boilers, the mud and water following the line of least resistence the same as the rest of us would do, which, in this case, for a good deal of it, at least, was up the vent, the mud falling to the bottom of the pipe and choking the drain, then piling up on the valve and destroying its usefulness as an atmospheric valve.

That scheme was then abandoned. A better way would have been to let the blow-off pipe discharge into a tank which could be supplied with a vent to dispose of the steam. The mud, which would settle to the bottom, could then be cleaned out when necessary.

As far as the leaky blow-off cocks were concerned, I think they were unnecessary. My boilers are blown down every day. They carry 115 lbs. pressure, and with the exception of just after blowing down, the pipes are cold which is a pretty good sign that there is little or no leakage. They are equipped with Duro blow-off valves, made by the Lunkenheimer Co. Two of them have been in use for two years, and have not been examined yet, and I believe they are tight, for the pipes are cold. This is not intended as a puff for the Duro, for there are, no doubt, better ones. I am only sating my experience for the benefit of those who have such troubles, and I believe that a proper selection of blow-off valve or cock will reduce such troubles or do away with them altogether.

---

## POWER PLANT EXPERIENCES.

By Mac.

The other day a brother engineer came to me with the request that I help him solve a difficulty that looked big to him. I went with him to his engine room where he showed me the source of his trouble; namely, a cross-head pin that he could not keep cool. He "had tried everything" without satisfactory results. The pin was oiled from a cup screwed into the connecting rod. I screwed off the top of the cup; yes, there was oil there all right, but I suspected that it went no further than the bottom of the cup and examination proved my suspicions well founded. The passage was plugged tight with hard grease, with which the pin had been oiled previously. A piece of wire solved the difficulty. None of the little things should be overlooked when trying to straighten out any trouble that arises in the power plant.

### Almost a Disaster.

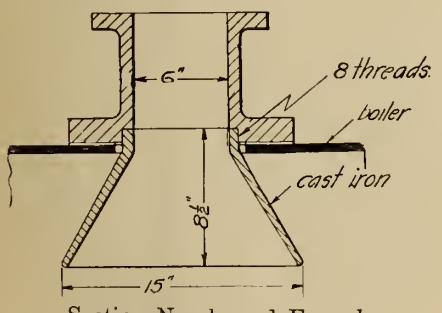
One day the water glass on one of our boilers broke. The fireman, who was the only one in the boiler-room at the time, ran for his ladder and taking his hat in his hand as a safeguard against scalding, went up to turn off the top and bottom gauge cocks. He turned his face away and reaching up through the steam turned off what he thought, was the top cock, and then the bottom. As the steam cleared away the top cock seemed to leak and on trying it he

found it was still open. After closing it and while putting in a new glass, he used the try cocks and found that the water was too high in the boiler—or at least it looked that way, as only water came out of the upper try cock. I happened to arrive on the scene when he had just finished putting the new glass in. On opening the cocks the glass filled with water. I sent him to blow down the boiler, thinking the boiler was too full. As this had no effect on the water in the glass I climbed the ladder and tried the valve on the pipe connecting the top of the water column to the boiler. It was closed tight. The fireman had reached too far through the steam and had closed this valve instead of the top of the water glass, and, of course, the pressure had kept the water column full. I was scared for a while for the water dropped out of the glass and I had no idea how nearly empty the boiler was. There was no explosion, but it is as close to one as ever I want to come. One should be always perfectly certain of the consequences attendant on the opening or closing of any valve before he tampers with it.

## WATER TROUBLES.

By N. H. W.

In the plant I have charge of are five 72''x18'x0'' boilers, two of which are late additions. We experienced a good deal of trouble on account of the first three throwing water over, and we had hard work to keep even an inch of water in the glass. The dry pipes in these boilers were of the ordinary kind, about 10'' in diameter, made of sheet steel. These were perforated in the top half as usual. I had an idea that the water drew up around the sides of the boiler and dropped into the dry pipe through




Section Nozzle and Funnel.

the holes, so I decided to try a change. I had three copper funnels made similar to that shown in the sketch, which were held in place by screws. The instalation of these did away with all the trouble, the funnels acting as a sort of umbrella. The two new boilers were equipped with funnels of cast iron made to the accompanying sketch.

### Trouble in L.P. Cylinder.

Another instance of water trouble occurred in one of the two 325 h.p. high-speed, direct connected engines in the same plant. This engine is a tandem compound. The trouble was with water in the L.P. cylinder when starting up and, before it was discovered three pistons went to the scrap heap Needless to say, it caused a lot of worry to the management and myself. We had several of the well-known experts over the engine but none of them could help us out, although they made plenty of suggestions. The makers, too, were at a loss to understand the trouble.

The drip pipe from the H.P. cylinder was connected to the receiver pipe of the L.P. cylinder, all according to the makers' designs. One day I was thinking the matter over and I decided to try an experiment. I disconnected the drip pipe from the receiver pipe and plugged the hole. Then I ran the drip pipe to the drip tank and since then have had no more trouble.

## HORSE-POWER OF PUMP.

By Frank L. Ferguson.

A question was put to me a few days ago, and as it may be of interest to readers, I submit it, with the answer.

A pump in doing a certain amount of work is known to consume five horsepower. The pump is 1½x6 inches, with 15 strokes. The water is discharged into a reservoir, and the work of pumping the water through the pipe line requires five horse-power. Required, the pressure per square inch against which the plunger is pumping, all losses to be neglected.

The quantity of water which the pump is delivering must first be found. As the diameter of the plunger is 1½ inches, the area is 1.767 square inches, and as the stroke is 6 inches and there are 15 strokes per minute, 1.767 multiplied by 6 multiplied by 15 equals 159.03 cubic inches of water pumped per minute.

If it were not known just what horsepower the pump was consuming, it could be found from the following formula:

Pounds of water pumped per minute multiplied by head in feet divided by 33,000.

But as the horsepower is known in this instance, 33,000 multiplied by 5 divided by pounds of water pumped per minute equals head in feet. Since one pound of water contains 27.7 cubic inches, 159.03 divided by 27.7 equals 5.741 pounds of water discharged per minute, so that by inserting this value in the formula we have: 33,000 multiplied by 5 divided by 5.741 equals 28,740 feet head, which the water is pumped against to consume five horsepower.

If it is desired to know the equivalent pressure per square inch acting against the pump plunger, all that is necessary is to multiply 28,740 by 0.434 equals 12,473.16 pounds per square inch pressure, as every foot-head equals a pressure of 0.434 pound per square inch.—Power.

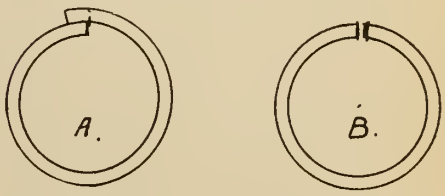
## PIPES AND TUBING.

By L. L. K.

I find that brass tubes for feed water are more servicable and keep clean longer than iron tubes, and do not wear out as soon. Near a coal mine, however, or where the water is acid, iron pipes and fittings should be used. The standard sizes of pipe are: ⅛, ¼, ⅜, ½, ¾, 1, 1¼, 1½, 1¾, 2, 2½, 3, 3½, 4, 4½, 5, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, 22 and 24. The size 4½ pipe is not used very much.

The best pipes to use for steam and water pipes with high pressure steam is lap welded, as shown in A. B shows a butt weld, but this tube cannot be bent like the lap weld and will stand no abuse.

Charcoal iron and wrought iron pipes are better than mild steel pipes.




Lap Weld Tube. Butt Weld Tube.

Wrought iron pipes can easily be detected. They are streaked and have little circular spots. These are roller holes.

Mild steel pipes are smooth and are welded at a lower temperature than those mentioned in the above paragraph. The best tubing is the Mannheim steel tubes, spun by hyperbolic rollers. Shelby solid drawn tubes are strong and smooth. They do not take up scale easily. There are no joints and they are good for high pressure.

In determining the diameter of a steam pipe a common method is to allow a steam velocity of 6,000 feet per minute. The resistance to the entrance of a pipe may be taken equal to a straight length, equal to 60 times the diameter, the resistance of a sharp elbow 40 times the diameter, and of a globe valve, 60 times the diameter. Allowing 40 lbs. of steam per h.p. per hour for a steam engine and 6,000 ft. per min. velocity, then

## CORRESPONDENCE.

We welcome discussion on articles appearing on the previous pages. Perhaps they suggest some experience you have had. Write us about it in your own way. We will prepare it for publication and will remunerate you for it. If you have difficulties we would be pleased to have you write about them to us and we will publish them in The Power House. Your name will be withheld if you do not wish it published.

We invite engineers to send in answers to questions asked. We pay for these also. Address, The Power House, 10 Front Street East, and it will reach the editor.

---

Editor of The Power House:

In your October issue I notice the results given of an evaporation test of the boilers in the plant of McCann, Knox Milling Co., Toronto, with and without the Cornell Fuel Economizer, which is quite interesting. There is nothing to show that the plant required more power or that any changes were made to make the engines more economical. If the plant and engines remained the same the quantity of water evaporated per hour should remain the same. The coal consumed per hour without the economizer was 920.4 lbs., and the coal consumed per hour with the economizer 807.27 lbs., which shows a saving of 12.29 per cent. in favor of the economizer. The evaporation from and at 212 degrees per lb. per hour of coal without the economizer is 9.47 lbs.; with the economizer is 19.08 lbs. or a gain of 101.48 per cent. I would like to have the owners of the economizers explain where this extra water evaporated went to if the engines did not use any more? If the engines did not use any more, the quantity of water should have remained the same, and the results of the economizer shown in reduction of coal only. If the engines used the same quantity of water and the total water evaporated increased it must have been required to supply the steam jets operating the economizer.

EDWARD B. PHELPS.

---

Editor of The Power House:

I have read with interest in your October issue the results of an evaporatic test of the boilers of the McCann, Knox Milling Co., Toronto. Without the economizer the average from and at 212 degrees per pound of coal is 9.47 lbs., or a furnace and boiler efficiency of 67.76 per cent., taking coal having 13,500 b.t.u. This is an average good result for horizontal tubular boilers, hand fired.

When the same boilers are equipped with the Cornell fuel economizer the results are most remarkable. The average evaporation from and at 212 degrees is given as 19.08, and for one day, March 11, as 21.57 lbs.

Coal at 13,500 b.t.u. has a theoretical evaporation of 13,500 divided by 966 equals 13.97 lbs. water per lb.; therefore the evaporation of 19.08 lbs. water from and at 212 degrees requires 19.08 multiplied by 966 equals 18431.28 b.t.u. If we credit this furnace with the high efficiency of 80 degrees, 1 lb. of coal would require 23039.1 b.t.u., or an addition of 9539.1 b.t.u. to the 13500 b.t.u. coal taken in the above example. With the furnace efficiency increased to 80 degrees there is 7431 b.t.u. per lb. of coal burned to be supplied by the hydrogen and oxygen supplied by the steam and air through the economizer.

The test was continued for a period of 9 days; 4 without and 5 with the economizer. The pressure was remarkably steady: viz.: 95 lbs. each day; the temperature of water also at 200 degrees daily. The average commercial horsepower without the economizer is given at 251.46, with the economizer 455.48 or 204.02, more than the ordinary furnace. The report does not state if there is additional machinery or heating when the economizer is used or if this additional boiler power was actually to drive the same machinery and heating of the mill.

The daily average power without the economizer appears to be very steady, varying between 244 and 261, being within 3.38 per cent. of the 4 days average. The daily average power with the economizer varies from 295 to 498 being 11.3 per cent. of the five days average.

It is not stated that the steam used through the jets connected to the economizer has been deducted from the evaporation. This should be done, or at least the b.t.u. required to evaporate the water required for this steam plus the b.t.u. required to superheat it, less the b.t.u. in the hydrogen and oxygen extracted.

No doubt the makers of the economizer can make plain the above points of this test as they appear to the observing engineer.

Yours respectfully,

J. O. B. LATOUR.

---

Editor The Power House,
Toronto, Canada.

Dear Sir,—We have your favor of November 25th enclosing copies of communications addressed to you under date of the 20th and 23rd regarding instalation of our economizer and smoke consumer at the McCann, Knox Milling Co. The McCann, Knox Milling Co.'s instalation consists of one 150 h.p. horizontal return tubular boiler, this boiler being 72" dia. by 18' long, containing seventy-two 4" tubes and thirty square feet of grate surface and one hundred pounds working steam pressure. This instalation was completed and started up on September 28th, 1908. The table published represents a test on two 125 h.p. boilers. The actual facts in regard to this table are that two instalations were made for one of the largest coal and coke producing companies of Pennsylvania, whose engineers made the test and tabulated the results. This company does not know anything about the manner in which the tests were made except that the water evaporated was measured by a Worthington hot water meter. We are quite aware that the results obtained were phenomenal and as one of your correspondents states, is more than one hundred per cent. of efficiency if the ordinary and accepted methods of calculation by b.t.u. were applied in this case, but we have found by experience that the b.t.u. of dry coal does not represent the conditions set up by our device in the furnace and while we do not wish to be understood that we are setting aside any of the recognized and known laws of combustion, we do claim that we have discovered and applied an entirely new method of combustion whereby the free hydrogen and oxygen gas produced approximates in this action the results obtained by oil or other combustible containing free hydrogen. It is an indisputable and well known fact that coals have different calorific value in proportion as they contain more or less hydrogen which can be utilized by being entirely consumed in a properly constructed and operated furnace. We have made many tests under the very finest conditions both before and after the application of our device to be sure beyond a doubt that we are utilizing certain hydro-carbons and hydrogen contents of fuel to produce effects which are not producible or recoverable by the ordinary and hitherto known methods of combustion.

Trusting the above answers you fully and thanking you for your interest in the matter; also assuring you that we will be very glad at any and all times to send you any additional information or data which we may have, we remain,

Very truly yours,

CORNELL ECONOMIZER CO.,
D. Townsend,
Secretary.

(If any reader wishes to investigate fully the Cornell economizer we shall be pleased to give him the address.—Editor.)

---

Editor of Power House.

Dear Sir: Thinking you might be interested in the change made in the lighting system of our store, I am sending

you this brief description. Until recently we had been supplying light and elevator power from our own steam plant. Having secured a favorable contract with the Montreal Heat, Light & Power Company, we decided to shut down our plant. The Power Company installed three 50 K.W., 2,200—550 volt transformers for motor service, and three 60 K.W., 2,200—110 volt transformers for lighting. As alternating current was to be supplied it was necessary to instal a type of lamp which would also permit the use of direct current if we ever had occasion to revert to our steam plant, which was retained and which is a D.C. plant. It was decided to use the new Tungston economy diffusers made by the General Electric Company. These diffusers consist of pressed steel reflectors, having a specially hardened white enamel reflecting surface. Each set is composed of six 50 candle-power lamps of the metal filament kind. The saving in power amounts to about 265 watts per set, or per 300 candle-power. A 300 c.p. arc light taking 6.5 amperes direct current at 110 volts, consumes 715 watts, while a set of six 50 c.p. Tungston lamps at 1.5 watts per c.p. consume 450 watts, or a difference of 265 watts. The resultant light is steadier, there is no shadow thrown and there are no violet rays that are hard on the eyes. We also recently installed an 8 in. x 12 in. triplex Gould pump for elevator service at a pressure of 135 pounds per square inch. The pump is belt-driven from a 50 h.p. C.C.L. Westinghouse motor at 550 volts. At the same time we installed an accumulator and discharge tank cross connected with our steam-driven pump so that we can run motor driven pump with the steam-driven or independent, in case of breakdown to either. Yours truly,

H. M. HUNT.

Engineer Henry Morgan Co., Montreal.

---

### The Boiler Law.

Editor The Power House.

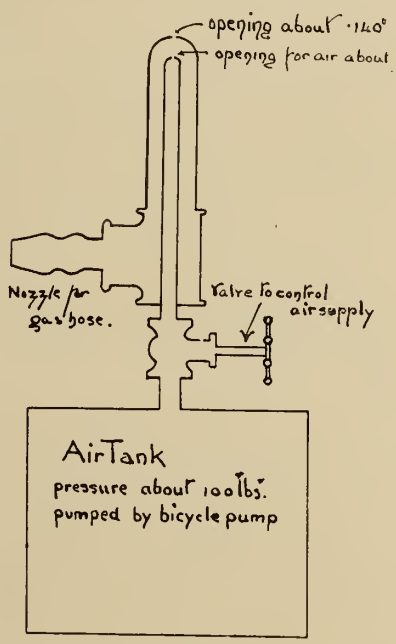
In reply to your letter dated November 27th, with regard to a uniform boiler law for Canada, we desire to say that in our opinion such a proposal would not meet with any support from the manufacturers of boilers in British Columbia. Our regulations here are, on the whole, rather more severe than those of the other Provinces of the Dominion, and what is also important, the regulations are strictly enforced. The manufacturers of boilers in British Columbia are unable, owing to physical conditions and the high cost of labor, to export boilers to the East, in which respect, of course, they differ from the manufacturers in the East, who do a trade with British Columbia as well. Under these conditions we are disposed to think that it would be a disadvantage, rather than otherwise, to the boiler manufacturers of British Columbia, if the existing differences between our regulations and those obtaining in Eastern Canada were abolished. We believe, moreover, that there is some ground for the stricter regulations in the fact that so many of the boilers manufactured in this Province are used in logging operations at points remote from the large centres of population, where it is difficult for the Government inspectors to make sure that the boilers are being used under proper conditions and maintained in proper working order. Yours faithfully,

VANCOUVER ENGINEERING WORKS, LTD., VANCOUVER.

T. L. Leighton, General Mgr.

---

Editor The Power House,—I wish to make a gas burner and have a tank




about one foot in diameter and about 16 inches long, which I wish to use as an air tank, pumping the same up to about 80 or 100 lbs. pressure with a bicycle pump. I have made one, but it does not prove entirely satisfactory. The enclosed sketch will give you some idea of my progress. The burner is not to be used all the time, but at odd times when I wish to harden and temper small punches, etc. I wish to know how to make a satisfactory burner and would thank any correspondent for information which will help me to perfect mine. Yours truly,

ROBERT DORMER.

---

Editor of The Power House:

Sir,—I was interested in the letter of Mr. Geo. B. Hedben, in your November issue. In reply I would state that he is quite correct in stating the law of the conservation of energy. The energy goes into heat but perhaps not to any appreciable amount. In support of this, I quote from Gage's Physics.

Thermo-dynamics is that branch of science that treats of the relation between heat and mechanical work. One of the most important discoveries in science is that of the equivalence of heat and work; that is, that a definite quantity of mechanical work can always produce a definite quantity of heat; and conversely, this heat, if the conversion were complete, can perform the original quantity of work.

The proof of the facts just stated was one of the most important steps in the establishment of the grand twin conceptions of modern science. (1) That all kinds of energy are so related to one another that energy of any kind can be changed into energy of any other kind, —known as the doctrine of CORRELATION OF ENERGY; (2) That when one form of energy disappears an exact equivalent of another form always takes its place, so that the sum total of energy is unchanged,—known as the doctrine of CONSERVATION OF ENERGY. These two principles constitute the corner-stone of physical science.

The experiment to ascertain the "mechanical value of heat," as performed by Dr. Joule of England, was conducted about as follows. He caused a paddle wheel to revolve in water by means of a falling weight attached to a cord wound around the axle of a wheel. The resistance offered by the water to the motion of the paddles was the means by which the mechanical motion of the weight was converted into heat, which raised the temperature of the water. Taking a body of a known weight, e.g., 80k, he raised it a measured distance, e.g., 53m high; by so doing 4240 k.g.m. of work were performed upon it, and consequently an equivalent amount of energy was stored up in it ready to be converted, first, into mechanical motion, then into heat. He took a definite weight of water to be agitated, e.g., 2k, at a temperature of 0 degrees C. After the descent of the weight the water was found to have a temperature of 5 degrees C.; consequently the 2k of water must have received 10 units of heat (careful allowance being made for all losses of heat), which is the amount of heat energy that is equivalent to 4240k.g.m. of work, or 1 unit of heat is equivalent to 424 k.g.m. of work.

As a converse of the above it may be demonstrated to actual experiment that the quantity of heat required to raise 1k of water from 0 degrees to 1 degree C. will, if converted into work, raise a 424k weight 1m high, or 1k weight 424m high. According to the English system, the same fact is stated as follows: The quantity of heat that will raise 1 lb. of water 1 degree F. will raise 772 lbs. 1 ft. high. The quantity, 424k, or 772 lbs., is called the mechanical equivalent of heat, or Joule's equivalent. Yours truly, READER.

## SOCIETY OFFICERS.

**Canadian Railway Club, Montreal.**

President, L. R. Johnson; treasurer, S. S. Underwood; secretary, James Powell, Box 7, St. Lambert, near Montreal. Meetings at Windsor Hotel, 1st Tuesday of each month, except June, July and August.

**Central Railway and Engineering Club, Toronto**

President, W. R. McRae; secretary-treasurer, Room 409, Union Station. Meetings at Rossin House, 3rd Tuesday of each month, except June, July and August.

**Canadian Society of Civil Engineers.**

Rooms at 413 Dorchester Street West, Montreal. President, J. Galbraith; secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1909.

**Nova Scotia Society of Engineers, Halifax.**

President, J. H. Winfield; secretary, S. Fenn, Bedford Row, Halifax, N.S.

**Quebec Branch of the Canadian Society of Civil Engineers.**

Chairman, E. A. Hoare; secretary, P. E. Parent, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

**Toronto Branch of the Canadian Society of Civil Engineers.**

96 King Street West, Toronto. Chairman, C. H. Mitchell; secretary, T. C. Irving, Jr., Traders Bank Building.

**Manitoba Branch of the Canadian Society of Civil Engineers.**

Chairman, H. N. Ruttan; secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

**Engineers' Club of Toronto.**

96 King Street West. President, J. G. Sing; secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

**Canadian Electrical Association.**

President, N. W. Ryerson, Niagara Falls; secretary, T. S. Young, Canadian Electrical News, Toronto.

**Canadian Society of Stationary Engineers.**

President, Charles Kelley, Chatham; secretary W. A. Crockett, Mount Hamilton.

**Toronto Branch A.I.E.E.**

Secretary, W. G. Chace, Confederation Life Building.

**Universal Craftsmen Council of Engineers. Canada Council.**

Chief, Chas. Mosley, 7 Charles St., W.; Secretary, H. E. Terry, 157 Bay St. Meets second Tuesday in each month in Room 2, 4th Floor, Temple Building.

**Toronto Branch C.A.S.E.**

Meetings 1st and 3rd Fridays each month at Forum Hall, corner Gerrard and Yonge Streets. Pres., F. Stubbs; Secy., W. C. Tait.

---

## TORONTO BRANCH C.A.S.E.

The opening meeting was held on Friday, Nov. 20th, and was addressed by C. B. Turner, representing the Mayers automatic boiler cleaner, manufactured by the Manchester Mfg. Co., North Manchester, Indiana. Mr. Turner in his address spoke on "The Internal Condition of Boilers." He referred to the condition in which boilers are often found, and said that it is only by experience that engineers learn how to take care of boilers. There are a great many theories brought forth by good authorities for preventing incrustations caused by oil, etc. The best authorities claim that to give a boiler long life one must keep the water pure. There has been a great deal of money spent in filtration systems. Some believe the scale in boilers to be caused by outer conditions. Inspectors who look over the boilers and hand in a report after a few minutes' inspection cannot be giving the care necessary in inspecting boilers. Mr. Turner quoted from his experience of explosions following the careless inspection of boilers, finding afterwards that the tubes were filled with scale and the boiler drums partially covered. One cannot guess at the condition of a boiler, which must be examined carefully. They cannot be inspected in a few minutes or even a couple of hours. To get at the true condition of boilers they must be very careful in inspecting them. Sometimes it is found that there are more impurities in one boiler than another, although the water in all the boilers is brought from the same city main. It is unquestionable, but it is so, and only a careful inspection by engineers and inspectors shows it to be so.

Boilers explode because of sediment quicker than they do from scale. Mr. Van Allan, Hartford, of the Steam Boiler Insurance & Inspector Co., states that there has been from 30 to 40 per cent. more explosions from sediment than from scale. A great source of danger is found in grease and lubricants where condensors are used or where exhaust steam is returned to the boiler. In such cases the oil used to lubricate the cylinder is carried into the boiler with the feed water. Mr. Turner then showed several samples of scale and boiler feed water before and after going through the Myers automatic boiler, and described the use of this device for purifying water.

A. M. Wivkens also referred to boiler scales and acid waters that pit boilers. Scaly boilers won't pit. In some cases lime must be put in to prevent pitting.

Mr. Wickens pointed out that if boilers were kept clean there would be fewer explosions and the life of the boiler would be longer. The boiler can be forced if it is clean. A thin film of oil is worse than a thick scale. The conductivity is greatly reduced with the film of oil. In an experiment to show how oil destroys the conduction of heat and water. An experiment has been tried with gas fuel where the heat units were known. A boiler was forced and the heat units noted on both sides of the boiler, then a thin film of oil was put on and there were 79 degrees difference. A thicker film about 1-16-inch thick was put on the inside and it showed 179 degrees difference. A high flash oil to stand the heat was put on and there were 600 degrees difference. This shows how bad oil is. Oil is the worst enemy of boilers and engineers should take every precaution to keep it out of the feed water where exhaust steam is fed back to boilers. Oil causes the seams to leak. Prevention is better than cure; and if water is put into boiler pure, there will not be so much danger from boiler scale and sediment.

The next opening meeting of the Toronto branch of the C.A.S.E. is on Friday, December 18th, when there will be a smoker, in which all engineers are invited.

---

## CAN. SOC. OF C.E.

The annual meeting of the society will be held in Toronto on January 28, 29 and 30, 1909. A detailed program will be sent to the members early in January.

A meeting of the Mining Section will be held at their rooms, Montreal, on Dec. 17.

---

## NOVA SCOTIA SOCIETY OF ENGINEERS.

At a well-attended meeting of the Nova Scotia Society of Engineers, held on November 17th, 1908, in the Telephone Building on Hollis Street, Halifax, N.S., a paper on "Highway Improvements," by D. McD. Campbell was read. The paper, a valuable one, was discussed by R. McColl, Provincial Engineer; F. W. W. Doane, City Engineer; J. W. McKenzie, Assistant Road Commissioner, and others. The next meeting is on Thursday, Dec. 10.

---

## ELECTRICAL CLUB, MONTREAL.

The Electrical Club, of McGill University met on Monday evening, November 30. A very interesting talk by Mr. Rupert Howard was the main part of the programme. Mr. Howard related some of the trials and troubles of a constructing engineer and the way in which they are usually overcome.

---

## ENGINEERS' CLUB, TORONTO.

On Thursday, December 10, R. C. Young will read a paper at their rooms, 96 King St. W., on Artistic Bridges for Populous Districts. The annual dinner is on December 17.

On December 3, T. Aird Murray, consulting engineer, read a paper on Sewer Disposal.

Mr. Murray pointed out that the two main questions to be considered in the case of a town proposing to adopt a system of sewage purification were, first, the degree of purification required in the circumstances of that town and of the river or stream into which its liquid refuse is to be discharged, and, second, how the degree of purification required can, in the particular case, be most economically obtained.

---

## PERSONAL NOTES.

Charles Brandes, C.E., will move into new offices at 4 Phillips Place, Montreal, on May 1, 1909.

Mr. Harry Charlton, advertising manager of the Grand Trunk, left yester-

1st on an extended trip to the West, including trips to Winnipeg, Seattle, Vancouver and Prince Rupert.

Baker & Jordall, engineering contractors, are moving from the Manning Chambers to larger offices in the Confederation Life Building, Toronto, Ont.

Mr. A. A. Bowman, Toronto manager of Canadian Rand Co., has returned from Winnipeg, where he has been for several months looking after the western business of the Canadian Rand Co.

Mr. N. B. Prichard has opened an office as a chemical and mining engineer at 40 Quebec Street, Sherbrooke, Que., giving special attention to sulphuric acid, smelting and power plants.

W. F. Simmons, for seventeen years general superintendent of the Light and Power Company, Kingston, Ont., and for the past four years general superintendent of the Peekskill Lighting and Railroad Company, Peekskill, N.Y., will represent R. W. Marshall & Co. in the Dominion of Canada. He is opening offices in Toronto, with a view of following particularly the electric railway trade throughout the provinces.

The Peterborough Lubricator Mfg. Co., Peterborough, has secured for its superintendent Wm. C. Pennington, of Goderich. He has had a long experience in similar work, having worked with the Canadian General Electric Company fifteen years ago and afterwards with the Carbon Porcelain Company. Later he was in charge of the Henderson Bicycle Co., Goderich, and from that firm went to the Raymond Co., Guelph, in whose employ he was for six years. He then returned to Goderich where he has since been.

Geo. C. Burnham, formerly associated with the Allis-Chalmers-Bullock Limited, has left that concern and entered into partnership with Kilmer & Pullen, under the style of Kilmer, Pullen & Burnham, McKinnon Building, Toronto, electrical engineers and contractors, representing the General Electric Co., of Sweden. This firm has during the past few years made several important instalations of power equipment for central stations and manufacturing plants. They are at present engaged on an unique instalation for M. F. Beach, at Iroquois, Ont.

John Mooney, Sarnia, late traveling engineer for the G.T.R., has been appointed to the important position of assistant superintendent of motive power on the Grand Trunk Pacific Railway, with headquarters at Rivers, Man. Prior to Mr. Mooney's departure from Sarnia he was made the recipient of a complimentary address, and a number of valuable presents, tokens of esteem from the railway men with whom he has been associated for many years past. Asst. Supt. A. J. Nixon presented Mr. Mooney with a handsome gentleman's toilet outfit; John Knowles presented him with a costly traveling bag, and the locomotive shopmen of London gave him a handsome meerschaum pipe.

## ORDER TO ABATE SMOKE NUISANCE.

The Railway Commission has made an anti-smoke order, which applies to Ontario cities, which have pased by-laws for the restriction of the smoke nuisance. Orders have been issued to the railways instructing them to equip all locomotives run within cities in the Province of Ontario with a device which will prevent the issuing of dense and opaque smoke.

It is recognized that such smoke must issue at times. The order therefore allows an engine to belch smoke for a minute in any ten minutes in each hour.

In the case of cleaning a fire-box or building a fire, an engine is allowed to belch for six minutes in any hour. In ascending the Scarboro grade at Toronto, and the Hamilton grade, engines are allowed to belch. There is a penalty of $25 for each violation.

## HISTORY OF MARCONI WIRELESS.

Chevalier Guglielmo Marconi, whose discoveries in the realm of science messages from one hemisphere to the other can be sent by "wireless," was a recent visitor to Toronto. In an interview he gave an account of the early history of wireless telegraphy in Canada that was in itself an indirect but handsome compliment to this young Dominion, which has the honor of being the first country in the world that officially recognized the worth of Marconi's inventions and made the first business agreement with him.

"You see," said the young Italian, "our first transatlantic tests were made between Newfoundland and England, but the cable companies objected to our experiments and were threatening a lawsuit when we received a telegram to come to Canada with a view to making arrangements to continue the tests. We made an agreement with the Hon. Mr. Fielding, which resulted in the fact that not only were we given facilities for the testing, but we were given a subsidy of some $80,000 towards the erection of the station at Glace Bay. The tests that followed were the first real tests we had made. Of course, afterward there came the signalling apparatus along the St. Lawrence. In return for the subsidy we agreed that our charges would not be more than ten cents per word for ordinary messages, and five cents for Government and press despatches. As yet we have not been pushing the work, since our stations are not fully ready. It is a year since we started sending regular messages between London and Montreal, and since then we have served many very large Canadian firms, including the G.T.R. They have expressed much satisfaction. In another three months we will be ready for heavy business. Our agreement with the Canadian Government contains no stipulations as to the length of time it is to stand. It is indefinite. We cannot ever raise the rate, though we may lower it. At present there are 24 shore stations on the St. Lawrence. How valuable they are in enabling vessel-owners to keep in touch with their captains, and in allowing captains, as in the recent smoke nuisance on the river, to keep in touch with the shore and thereby have an idea of their whereabouts in such weather, is indicated in the fact that the owners are to-day asking that the Government instal twelve more stations to further improve the service."

## DEPRECIATION OF STEAM PLANT.

It is impossible to establish a hard and fast basis for depreciation of a power plant. But Mr. Charles T. Main, Mill Engineer of Boston, very concisely presents the average conditions as follows: "With good water and good care, running about twelve hours a day, the life of a boiler should be about twenty years, or the depreciation five per cent. a year. Slow-speed engines, running ten hours a day, can be estimated as having a life of about twenty-five years, or a depreciation of four per cent. a year. High-speed engines are much shorter lived, and will not average over fifteen years, or a depreciation of about seven per cent. a year; and often times it is greater when run ten hours a day. The depreciation when run twenty to twenty-four hours a day is correspondingly greater. Boiler settings and piping should be included with the boilers, and engine foundations and piping with the engines. The life of economizers varies with the initial temperature of the entering water from about ten years up to forty."

The Standard Engineering Co., 43 Scott Street, Toronto, manufacturers mechanical stokers and steam specialties, have opened a branch office at 234 Coristine Bldg., Montreal.

The Peterborough Lubricating Mfg. Co., Peterborough, have opened a sales and demonstration office at 127 Bay Street, Toronto. The office will be in charge of Alfred Cornwell as sales manager. Fred. T. Deville has been engaged as traveling salesman.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

CANADA
MONTREAL - 232 McGill Street
Phone Main 1255
TORONTO - 10 Front Street East
Phone Main 2701
WINNIPEG, 511 Union Bank Bldg.
Phone 3726
F. R. Munro
BRITISH COLUMBIA Vancouver
R. Bruce Bennett
1737 Haro St.

GREAT BRITAIN
LONDON - 88 Fleet Street, E.C.
Phone Central 12960
J. Meredith McKim

UNITED STATES
CHICAGO - J. Purkis Sharpe
933-935 Monadnock Block
NEW YORK - R. B. Huestis
622-624 Tribune Bldg.
Phone 4535 Beekman

FRANCE
PARIS - Agence Havas
8 Place de la Bourse

SWITZERLAND
ZURICH - - - Louis Wolf
Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.


## CONTENTS


The Electrification of the G.T.R. Sarnia-Port Huron Tunnel - 9
A Miniature Engine - - - 13
Ontario's New Licence Law and Engineers' Examinations - 14
Engineers' Examinations in British Columbia - - 16
Some Interesting Data on Composition of Producer Gas - 17
Electric Smelting and Producer Gas Engines - - - 18
Course of Lessons for Instruction of Stationary Engineers 19
Unique Producer Gas Instalation 20
Transmission Line of Hydro-Electric Commission - - 20
Development - - - - 21
Replies to Correspondents - 21
The Westinghouse New Model Roney Mechanical Stoker - 22
Practical Articles by our Readers 24
- Horse Power of Shafting.
- Horse Power of Leather Belts.
- Changes for a Better Service.
- Steam Trap Instalations.
- The Water Column.
- Troubles With Racing Engines.
- Repairing Duplex Steam Pumps.
- Emergency Repairs.
- Economies in Steam Heating.
- Repairing a Blistered Boiler.
- Boiler Experiences
- Power Plant Experiences.
- Water Troubles.
- Horse Power of Pump.
- Pipes and Tubing.

Correspondence - - - 30
Societies - - - - 32
Personal - - - - 32
Order to Abate Smoke Nuisance 32
History of Marconi Wireless - 33
Depreciation of Steam Plant - 33
Editorial - - - - 34
New Equipment - - - 36
- Beaver Die Stock.
- Oiling Device.
- Internal Steam Separator.
- A. C. Motor Friction Brake
- Evaporators.
- Water Pipe Insulation.
- Portable Tachometer.

Power Plant Developments - 39
Catalogues - - - - 40


### CARELESSNESS IN THE POWER PLANT.

Another regrettable accident, which could most easily have been prevented, draws our attention to the carelessness to which familiarity with danger seems to lead. The accident to which we refer, happened to a fireman whose work called for the use of a torch lamp. His lamp being nearly empty, he tried to fill it without first extinguishing the flame and the result was an explosion which burned him very badly, probably fatally, and set fire to the surroundings.

Although this man knew it was dangerous, he had done it so often before, that familiarity had blinded him to the danger and made him careless. The man who continually risks his life or health on account of laziness or in an attempt to save time, will, nine times out of ten, become careless and belittle the danger he runs until it is brought forcibly home to him, as in the case quoted or to those who are suddenly left behind.

Forcible demonstrations of the result of carelessness are of too frequent occurrence, and the unfortunate part is that they are so little heeded.

### RECIPROCITY IN COAL.

The steel, coal and lumber interests in the United States are making a stubborn fight for a reduction of tariff on these products. West Virginia, which produces a large amount of these products, is entirely satisfied with the existing rates and will put up a contest before she submits them to be changed.

The people of Massachusetts, however, desire that bituminous coal be free. Canada buys more than three tons of bituminous coal from the United States for every ton that is shipped into the States. On every ton imported into Canada there is a duty paid to the U. S. Government. Similarly for every ton of bituminous shipped into the States a duty is paid to the Canadian Government. The Canadian railroads pay about $1,000,000 per year duty on coal imported from the United States.

Ontario must have United States coal; the New England States must have Nova Scotia coal, and it is hoped that the Canadian Government will interest itself in this important question, and that reciprocity of bituminous can be arranged.

### THE EDUCATION OF ENGINEERS.

Engineers generally are interested in the subject of education. We are aware that just as no one man can hope to become expert in every line of engineering, so no one method of instruction is equally applicable to all subjects and cases. With a little assistance we have seen practical engineers rise in their work to be chief of the plant in which he works, and then advance to a larger sphere of work. Some require personal instruction, others are assisted by lectures, and still others advance by reading modern textbooks and literature.

The personality of a lecturer who can impart knowledge in short, clear sentences is, no doubt, the best manner of instruction. Many engineers, however, cannot afford the expense which this method entails. For these latter and all the others interested, we begin with this December issue of The Power House, a series of lessons embracing gas, electrical and steam engineering, written in simple language, by W. A. Crockett, executive secretary of the C.A.S.E. Having been associated with engineers for several years and being an engineer himself, he is well qualified to edit such a course of lessons that will be of greatest benefit. The lessons have been made as clear as possible and can be followed by every engineer.

If there is anything a reader does not fully understand we will be glad to have him write us of his difficulties and we will endeavor to assist him in his work.

The first lesson is on Heat, Sensible and Latent. In this article, as well as in succeeding ones, mathematics have been made as simple as possible and the lesson is a collection of valuable material expressed in simple form. We trust it will be of great value to engineers.

## WHY NOT A TECHNICAL PUBLICITY ASSOCIATION IN CANADA.

In New York there exists an association well known among publishers of trade papers, engineering and technical magazines with a membership consisting of those who are actually filling the position of advertising manager in concerns engaged in manufacturing machinery or in concerns who are allied with the machinery industry.

Probably one of the association's most important accomplishments is the securing of statements and information pertaining to advertising mediums. The circulation committee keeps records relating to circulation and statistics of various papers, obtaining new or revised information on request of members, who hold same in strict confidence.

There are no axes to grind in this association. Topics under discussion at meetings are usually laid bare and studied from every view point. The friendly interchange of ideas, the real experiences, with co-operation from interested friends have made the association very edifying and largely recognized among the advertising fraternity throughout the entire country and abroad.

With such an association in Canada there would be more publicity given to new machinery. The advertising department in most United States companies is well organized and publicity is given to every new machine placed on the market, the technical papers being given full information in regard to them.

In Canada technical papers come across new machines accidentally. The Canadian advertiser has not been educated in making them known, and the establishing of such an association would do much towards bringing out methods of obtaining publicity and show a manufacturer how to make best use of facilities at his command. People do not know about some of the machinery being built in Canada and making them public would interest the reader, give the manufacturer publicity and do justice to our country.

One good point about United States and Canadian publications is the space given to new machinery being placed on the market. In the Bulletin of the association for November, giving the proceedings of the meetings and a list of the members, is printed a speech on Foreign Publications by President C. S. Redfield, of the Technical Publicity Association, in which he states that there were a poor quality of trade papers in Europe giving as a reason the little demand.

There is a demand for good trade papers in Canada and th United States. The establishment of a technical Publicity Association in Canada along similar lines to the above organization would be of great benefit to both advertising and sales departments connected with manufacturing and supply houses.

## DOMINION ORGANIZATION OF STATIONARY ENGINEERS.

A movement is on foot among the stationary engineers of Quebec towards securing incorporation and establishing a central examining board to reorganize the methods now employed in granting certificates.

There seems to be a very strong feeling among some of the engineers of Quebec Province for a Dominion organization embracing all the Provincial societies from coast to coast. C.A.S.E., incorporated 1887, while strongest in Ontario, has a preamble which shows the broad character of the organization. Its preamble has been printed before in these columns, but for the benefit of non-members of this organization we reprint it herewith:

This association shall at no time be used for the furtherance of strikes or in any way interfere between its members and their employers in regard to wages. It shall recognize the identity of interests between employer and employe and shall not countenance any project or enterprize that will interfere with perfect harmony between them. Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the promotion of educational, professional and mechanical knowledge.

It would be a splendid thing for all concerned if the stationary engineers would join hands in a Dominion organization. Such an organization could better look after the legislation now being carried out in the different Provinces. At present, if an engineer possessing a Quebec certificate wishes to assume a position in Ontario he must try a new examination and take out a new certificate, necessitating, generally, a loss of time and a great deal of inconvenience.

The same difficulty met by the C.M.A. in regard to boiler inspection again presents itself. A Dominion Act governs marine boilers and marine engineers. For stationary boilers the C.M.A. is approaching the various Provinces to have similar laws enacted. This procedure would have to be followed in securing stationary engineers' regulations. Those of British Columbia reprinted in this issue are as exclusive as those of the English Board of Trade. As yet Manitoba has no law, but we have the authority of the Deputy Minister of Agriculture of Manitoba that legislation governing engineers will likely be enacted during the coming session.

If similar laws were enacted it would be possible to publish a book suitable to Canadian stationary engineers. At present the sale of a book written to suit the requirements for each Province would be limited and a book embracing all the Provinces would be cumbersome and costly.

We would like to see an organization such as the CA.S.E. with lodges in every important centre in Canada. Annually a convention of the C.A.S.E. is held. This is a chance to meet other men in the same line of work, and exchange ideas. This is invaluable to those who attend and an inspiration. The C.A.S.E. is organized for the purpose of improvement and for the better education of its members in steam, gas and electrical engineering. The worthy objects for which this organization stands should commend it to the engineers in every Province in Canada.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### BEAVER DIE STOCK.

This die stock is intended to meet the requirements of a small tool and threads the four smallest standard sizes of pipe, ¼-inch, ⅜-inch, ½-inch and ¾-inch, without removing the chasers

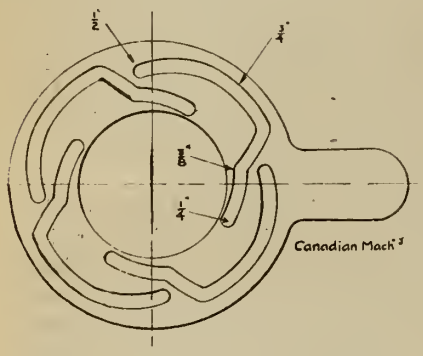



Fig. 1.—Plan of Bottom Cam.

from the stock. The difference between this tool and the larger sizes of the same make is that in this tool two sets of chasers are used instead of only one set. These chasers are operated by a single cam so constructed as to move one set of chasers back while the other is in use. Each set is composed of four segments which are entirely separate from each other so as to be readily removed and sharpened. Fig. 1 is the plan of the underside of the cam or adjusting plate, and shows the slots which engage the pins on each chaser.

When the stock is set to thread ⅜" pipe the pins on chasers marked A are in the position shown by arrow (⅜) in Fig. 1, the pins on chasers marked B being held in the outer part of the slots as shown by arrow (¾). Movement of the cam towards the setting necessary to thread ¾-inch pipe brings the pins on the chasers marked B into the outer slot, thus throwing the chasers clear of the larger size pipe. Further movement of the cam plate in this direction moves the pins in chasers B to the position shown by arrow (½) while the chasers A remain unmoved on account of the slot at arrow (¾) being concentric. The clearance for the larger size pipe is further assured by placing the pins on chasers B nearer the outside end than those on chasers A.

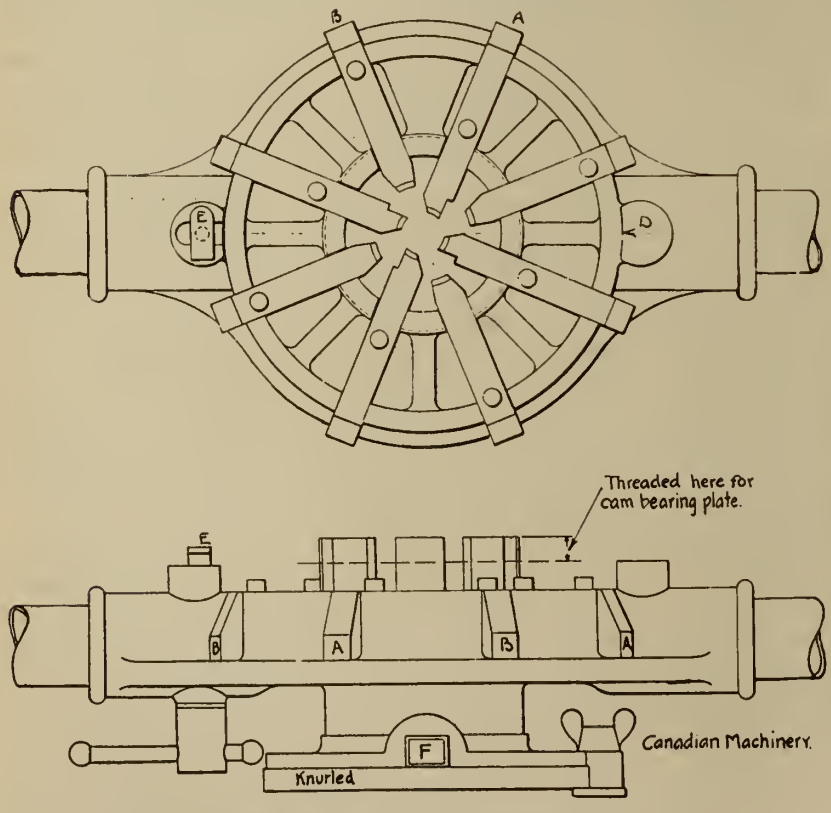



Fig. 2.—Plan and Elevation of Die-Stock (Cam Removed).

The pointer at D coincides with indicator marks on the top of cam. The clamp at E is to hold the cam and chasers in position. A bearing plate is screwed on above the cam and serves to take up all wear.

An additional feature is the adjustable bushings to steady the stock on the pipe. These bushings, in 3 segments, are also operated by a slotted cam, the outer edge of which is heavily knurled to facilitate operation. These bushings take up any differences, however small, in the diameter of the pipe, and are held in place by a thumbscrew clamp.

The whole stock is sturdily made of malleable iron, the parts are simple and easily cleaned. The Beaver die stock, in six sizes, ranging from ¼-inch to 12-inch, are manufactured by the Borden-Canadian Company, 66 Richmond Street, east, Toronto.

---

### OILING DEVICE.

The object of the design of a device for oiling the crank pin of a high-speed centre crank engine is to provide a continuous conduit or tube from a stationary oil supply or oil cup to the crank pin when the engine is in motion. The tubes telescope and are long enough to permit of a lap when the engine is on the bottom centre. The tubes and joints are made of hardened steel. The longest time one of these has been in operation is on an engine running 300 r.p.m. ten hours a day for three years, and upon examination the joints showed no wear and very little wear on the tubes. The whole device is self-lubricating, and

Nugent's Oiling Device.

a new set of tubes costs about one dollar, so the maintenance of this device is very small in comparison with the able and positive way in which it lubricates the crank pin.

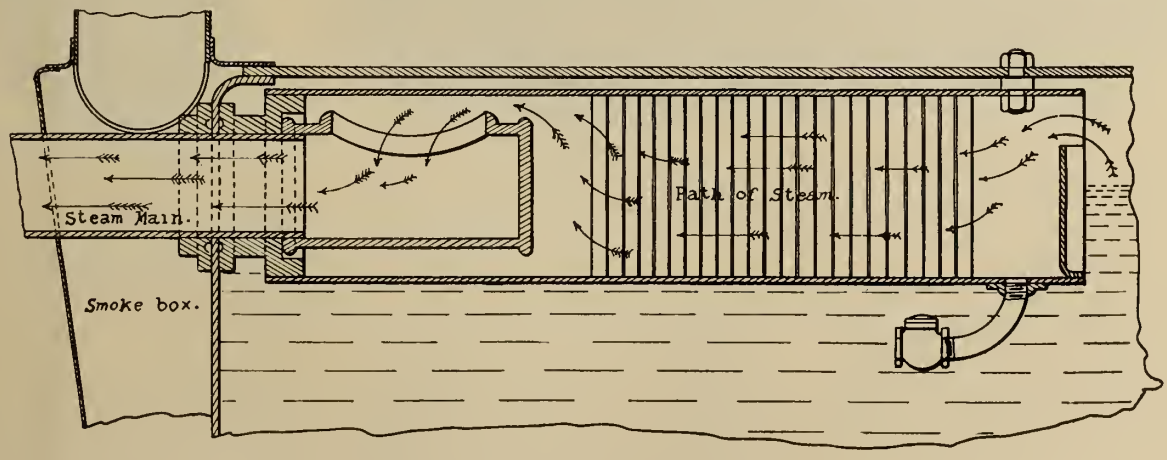
This device is manufactured by Wm. W Nugent & Co., 18-30 West Randolph St., Chicago.

## INTERNAL STEAM SEPARATOR.

The Ideal steam separator is placed in the inside of the boiler and connected to the steam outlet by metallic steam-tight joints. All steam passes through the separator before entering the main steam pipe. The water and saturated particles are eliminated therefrom, thus delivering dry expansive steam to the engines, pumps or heating system.

The Ideal steam separator consists of a metallic casing, with spacing rings, screens, perforated and corrugated plates, placed in such a position as to separate all the saturated particles from the steam on its passage to the outlet. The water being the heavier body falls or gravitates to the bottom of the separator, from whence it is discharged into the boiler below the water line, through a floating swing check. Of course different boilers and positions of outlets demand various methods of connecting. The illustrations show the instalation at the Central Prison, Toronto. This was the beginning of the Ideal separator, and was installed two years ago. Mr. Allison, who is the inventor, took hold of this job, and this device was the result. It has been the cause of saving over a third of fuel since its instalation. Some idea of the efficiency with which the Ideal has acted at the Central Prison plant may be gathered from a letter from Mr. D. M. Metcalfe, Inspector of Boilers for the Province of Ontario. "In reference to the Ideal internal separators installed in the boilers at the Central Prison, Toronto, I beg to say it is not customary to give testimonials from this department, but in this case exception will be made. Two years ago an electric light plant was installed in the prison, and it was found necessary owing to water being carried over to the engine to cut off all the steam supply from Bonson boiler. This boiler's steam outlet is taken from the front head and is carried over in large quantities. After a special internal separator was made and installed this boiler was again connected to the lighting plant and the results from the same were satisfactory in every respect. From information received from the operating engineers, and from my own observation, the trouble from water being carried over to the engine was completely remedied."

Several other instalations have been made, and in these cases there have been no troubles from water shocks. This separator is being manufactured by the Ideal Steam Separator & Supply Co., 73 Adelaide Street East, Toronto. under the supervision of Mr. Allison. They are agents for the Potter Separator and Whaley Automatic Smoke Preventer.



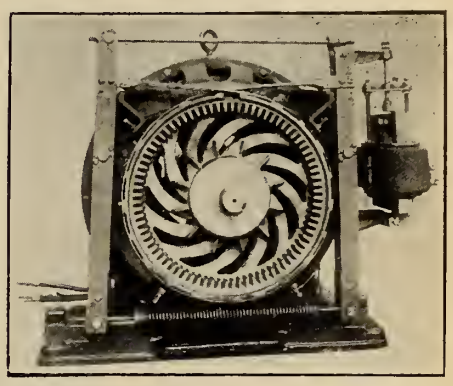

Ideal Internal Steam Separator.

## A. C. MOTOR FRICTION BRAKE.

A type of alternating current brake has just been placed on the market. This brake is characterized by simplicity and strength in construction, and reliability in action; it is self-contained, and is readily applied and easily adjusted. It is operated by electro-magnets.

The brake referred to, designated as the "P.B." type, is intended for use on Westinghouse two and three-phase induction motors of from 5 to 100 horsepower, 25, 40 and 60 cycles. The braking action depends on the contraction of a coiled steel spring.

The advantage of this construction is that the brake will operate equally well with the motor tilted at a considerable angle from the horizontal position, as on roller lift draw bridges. The construction is shown in the illustration. The cast iron brake shoes are held against the brake wheel by steel bands. The two vertical pivotal brake beams are connected at the top by a tie rod and at the bottom by a coiled steel spring; and a polyphase solenoid operating magnet is attached to the brake beams by a lever. The ends of the brake bands are attached to the beams above the pivots; the spring tends to draw the lower ends of the beams together, thus drawing the band and shoe against the wheel.



A.C. Motor Friction Brake.

The friction of the wheel against the shoes tilts the beams through a small angle until they strike against lugs on the frame work. These lugs are above the pivots and are so placed that when the beams press against them the tops are separated and the brakes more firmly set by the motor itself. A very heavy braking action is thus obtained with a comparatively light spring and magnet. When the operator is operating, the current passes through the coils, the core is pulled down, the brake is released and the spring elongated. On stopping the motor the brake circuit is opened, allowing the spring to contract and apply the brake.

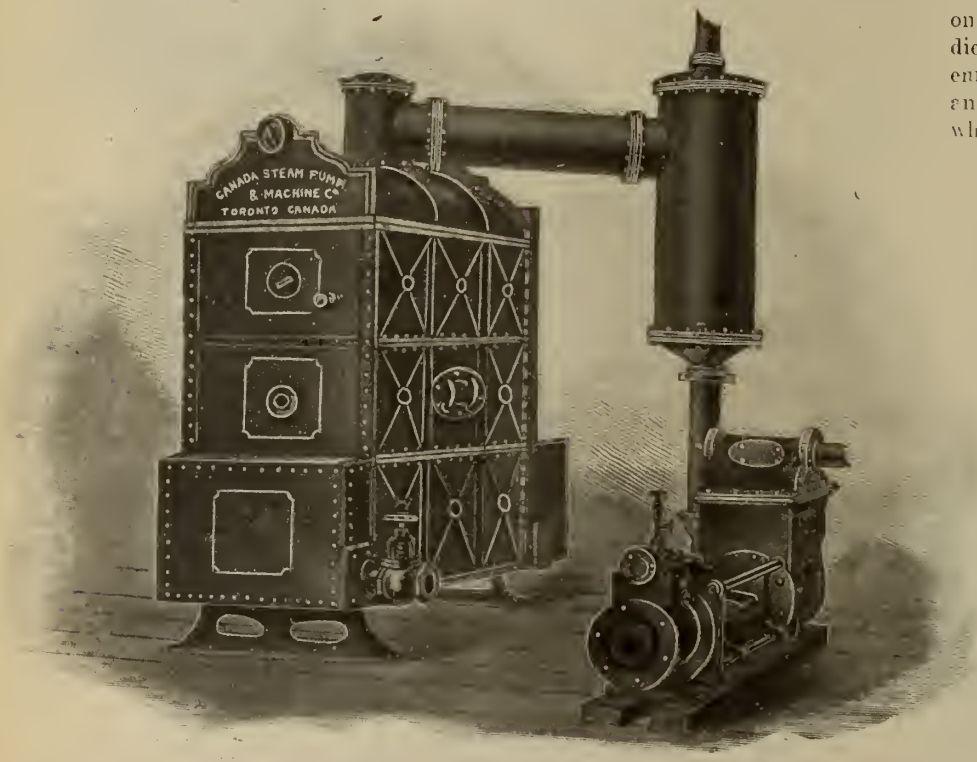
This brake is manufactured by the Westinghouse Co., Pittsburg.

## EVAPORATORS.

The illustration shows a single evaporator and these may be combined giving a double, triple, etc., effects.

The Multiple Evaporator is designed, for its adoption in practically all industries requiring evaporation in a vacuum, and it has been modified to meet the requirements in each particular case, without sacrificing any of its good features. The following is a partial list of industries using single and double evaporators: Cane and beet sugar, beef extract, licorice, hide and bone glue, caustic soda, gelatine, glycerine, tannin extract, tank water, sugar of milk, pepsin, malt extract, distilled water, cream of tartar, salt, soda pulp, glucose.

The lower part is filled with tubes which may be removed and cleaned. The




Canada Pump and Machine Company Evaporator—Single Effect.

ends are built on the steambox principle. It is equipped with a manhole on the side. A vapor pipe on top passes to the condenser and discharge is made by means of the vacuum pump.

In triple effects the exhaust steam is passed into the steam box which boils the material in machine No. 1, the vapor of which is carried to steam box No. 2, which again boils the material, producing a second vapor which is carried to steam box No. 3. The vapor of the third is taken to the condenser carrying from 25 in. vacuum, the material boiling at 133 degrees. At 26 in. material boils at 125 degrees. The capacity of a single machine is equivalent to evaporating 300 gals. water per hour.

A valve at the top and front lets in air and destroys the vacuum when this is necessary. A test tube and thermometer are included in the equipment. The material is pumped out of the evaporator.

These evaporators, in single, double and triple effects, are manufactured by The Canada Steam Pump & Machine Co., 97 Richmond Street East, Toronto.

## "LEAK-NO" METALLIC COMPOUND

The H. W. Johns-Manville Company, of New York City and Toronto, Ont., has placed on the market the "Leak-No" metallic compound for repairing leaks and defects in iron and steel. It is chemically prepared, resembling powdered iron, and is mixed with water and applied like putty. The manufacturer claims that it metalizes and becomes a permanent part of the article to which it is applied.

## WATER PIPE INSULATION.

A footbridge attachment is under construction over the traffic-bridge, in Saskatoon. Under the footbridge a water main is being laid to connect the power-house with the water tower on Nutana hill. Temporary pipes laid across the main bridge froze solid and burst. A rather unique scheme is under way for keeping the permanent main from freezing during the winter months. The pipes all the length of the bridge, some 950 feet, will be wrapped in hair insulator and then covered with vitribestic lagging containing air cells. This will then be encased in a wooden jacket or box in which will be placed a number of electric car heaters which will be connected up and heat turned on when the thermometer drops below the zero point. The pipes have been successfully connected up and the wrapping process is now in progress.

## PORTABLE TACHOMETERS.

These are based on the action of centrifugal force on weight pivoted on a rotating spindle. The movement of these weights, when rotating, is controlled by gravity, or by springs, and is indicated by a pointer mechanically connected to them. The pointer, therefore, at any moment indicates the exact position of the rotating weights.

The readings are independent of the duration of the test. They can be read on the dial of the instrument and indicate the smallest speed variation occurring during a fraction of a minute and are independent of the direction in which they are driven.

Portable Tachometer.

They are mounted on alloy cases, highly polished and lacquered. Each instrument is supplied with triangular steel points, rubber points and funnel centres, extension bar for the spindle and disc pulley.

The disc pulley is used for determining belt, rope and periphery speed. A v-shape groove is turned in the edge of the disc pulley or measuring wheel, and where shafts are not easily accessible, the measuring wheel can be driven by a thread which is passed round the shaft and runs in the groove of the measuring wheel.

This tachometer is manufactured by Schuchardt & Schutte, 91 Youville Sq., Montreal.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Trade Notes.

The Victoria, B.C., Machinery Depot has supplied a 150 h.p. boiler to W. J. Pendray & Sons, manufacturers of paints and soaps.

An order has been received by the Nernst Lamp Company for three-glower lamps to replace the six-glower Nernst lamps in the corridors of the Frick building, Pittsburg.

The Jones Stoker Company have just completed the instalation of two stokers in the Canadian building, Ottawa. This is a heating plant only—the electric power being purchased outside.

The Central Heat, Light & Power Company, Montreal, have added to their plant a Belliss and Morcom 430 h.p. direct connected Canadian General Electric Company's Witton machine, 300 k.w. capacity. The instalation is being made by Laurie & Lamb, Montreal. This brings the capacity of the plant up to 735 k.w.

The Hill Electric Switch Company, Limited, 1650 St. Lawrence Boulevard, have been awarded the contract to supply the new Workman building of McGill University with its equipment of main switchboard and panel boards. The panel board and cabinets for the new Eastern Townships Bank building in this city are also being built by the Hill Electric Company.

The big Worthington pump recently installed for Montreal has received its final test and has proven "up to contract" in every respect. The contract called for a capacity of 12,000,000 gallons per 24 hours, and a duty of 160 million foot pounds per 1,000 pounds steam. The test showed the duty to be over 175 millions and during the latter part of the test the pump was run at the rate of 14½ million gallons per 24 hours, with a very small decrease of duty.

The Dominion Mining Company, Tangier, N.S. are making extensive improvements at their mine. They have recently placed an order for a large compound duplex air compressor, of the belt-driven type, with the Ingersoll-Sergeant Company of Canada, Limited. This machine will have a capacity of about 1,000 cubic feet, and will be belted to an electric motor. The company will instal a hydro-electric plant near the mine. The water turbine will be about 600 h.p., and will operate under a head of 18 feet. The current will be used to drive the compressor, hoist and mill.

### Power Propositions.

J. E. Hughes, Inverness, has been figuring on putting in a small plant for lighting the town.

The first Canadian electric locomotive is now being built in the Canadian General Electric works, Peterboro. It has been built for use in a tunnel at Shawinigan Falls.

Plans are being made to organize a local telephone company to build a system in the town of Dundurn, Sask., with rural lines to adjacent districts. E. J. Mcilicke is interested.

At a meeting of the Marine and General Engineering Company, Sydney, N.S., the directors outlined plans for the future and decided to install power shortly in their plant on King's Road.

The engineering staff of McGill University, Montreal, are considering plans and equipment for the instalation of a central plant for the generation and distribution of the power used in the various buildings.

At the approaching municipal elections in Windsor, Ont., the ratepayers will be asked to vote on a by-law to authorize the expenditure of about $25,000 or $30,000 in order to provide a practically new lighting plant for the city.

The Deloro Mining and Reduction Co., Ltd., are negotiating for electric power from Campbellford. It is stated that the contract calls for 500 horse power delivered at the mines. Marmora may also secure power from the same source.

The Wentworth county council has granted a franchise to F. Reinke and C. Shaver to erect a telephone line between Ancaster, Ont., and Waterdown, Ont., a distance of about 21 miles. The cost of the system is estimated at about $10,000.

The Nova Scotia Steel & Coal Company, Limited, are progressing rapidly with the development of their Wabana mine. They will instal machinery shortly, and are figuring on an engine-driven generator of about 500 k.w.

A telephone company has been formed in Cranbrook, B.C., to be known as the Kootenay Telephone Company, Limited, which will be capitalized at $200,000. It has purchased the Cranbrook Telephone Company's system and will operate within the boundaries of British Columbia.

A project is under way to connect Morrisburg with Ottawa by an electric railway. The proposal is to build a line from Morrisburg to a point on the New York and Ottawa Railway, which extends from Ottawa to Cornwall, and to utilize about 20 miles of the New York and Ottawa line from Russell Village to Ottawa.

W. D. Barclay, manager of the Inverness Railway & Coal Company, is considering the instalation of a new electric plant for furnishing light for their mine at Inverness and also supplying about 1,000 lights to the town. If the company decide to instal this plant, which will be steam-driven, they will require about 80 or more arc lamps. They will run a 3-phase, 60-cycle circuit.

Mr. McKenzie, chief engineer of the Intercolonial Railway, has asked for tenders on the electrical equipment for the power house of the Prince Edward Island Railway at Charlottetown, which consists of a 75 k.w. direct-current generator, with potential of 230 volts, direct connected to and mounted on same base with engine. The specifications state that the generator must be under control, so that it will not show a variation as great as 2 per cent.

A deputation from Hastings County waited on Hon. Frank Cochrane, Minister of Lands, Forests and Mines, and asked for the erection of dams to regulate the flow of water in the Moira river, which empties into the Bay of Quinte. The delegation said that an expenditure of about $35,000 would ensure a supply of 22,000 h.p. of energy continuously. This, it was said would provide electricity for Belleville, Tweed, Madoc and other towns, and also to the mining industry in the country. The deputation included Town Solicitor Mikel, of Belleville; Henry Corby, ex-M.P.; J. W. Pearce, M.P.P.; J. M. Johnston, M.P.P., and Amos Richardson, M.P.P., the members of the legislature for Hastings County.

The Dufferin Light and Power Co., in which Toronto, Orangeville and Shelburne men are interested, has bought out C. W. Watson's electric lighting plant and system in Orangeville. James Pickering's plant in Shelburne and the Huxtable water privilege at Horning's Mills. The Company, which has a capital stock of $200,000, proposes to develop 800 or 1,000 horsepower at Horning's Mills and supply Orangeville, Shelburne, Grand Valley, Dundalk and possibly other places with electric energy for lighting and power purposes. The company has taken over and commenced to operate the Orangeville and Shelburne plants. Development work at Horning's Mills will be commenced early next spring and pushed through as speedily as possible.

### Municipal Undertakings.

The waterworks mains in Ottawa will likely be extended to Rockcliffe.

Owen Sound will vote on a by-law to expend $100,000 on the extension of its waterworks system.

The by-law providing for the establishment of a civic electric lighting plant in Glencoe, Ont., was carried.

North Vancouver will have a new service reservoir in connection with its proposed waterworks extension.

The sewers committee of Hamilton has awarded the contract of installing a sewer system on the mountain to Geo. F. Webb, at $26,140.

The ratepayers of Saskatoon, Sask., have approved a by-law to raise $30,000 for extension to the electric light plant.

The waterworks of North Vancouver will be extended, the recent sale of $35,000 of city waterworks bonds enabling the work to be proceeded with.

Haileybury will go ahead with a sewerage system, $20,000 bonds bearing 5 per cent. interest and repayable in 30 years having been disposed of to private citizens.

Gravenhurst is considering the question of waterworks and it is proposed to give a private company the right to lay the mains and instal a pumping station.

The International Heating and Lighting Co., of Cleveland, will instal a gas system in Portage la Priairie in 1909, and an extension of the time of the franchise is being asked.

J. Hicks, representing the Economical Gas Apparatus Construction Co., Toronto, has made an offer to the City of Regina to instal a gas plant in that city and expend $150,000 in construction.

Edmonton is now operating their new gas-producer plant. This plant was purchased from the Loomis-Pettibone Company, of Cudahy, Wis., and cost $100,000. This new plant will double the capacity of the electric plant and also supply power for the municipal street railway.

Hamilton fire and water committee has accepted the tenders of the Canadian Westinghouse Company, Hamilton, and the John McDougall Company, of Montreal, for motors and pumps for the Beach pumping station, the combined cost being $20,148, or $2,028 higher than the tender of the General Electric Company, of Sweden, with the Montreal pumps.

Warren Overpack, of Webster City, Iowa, who is on the coast, is looking for a suitable site for the establishment of a sewer pipe manufacturing business. He was in Medicine Hat last week and talked the matter over there, stating that the outlay would be $150,000, and that from 60 to 75 men would be employed the year round. With the development of the west, there is an increasing field for this kind of business. The proposal in Medicine Hat has progressed so that a statement is being got ready for a vote by the citizens.

### Kakabeka Falls Power.

The Mount McKay and Kakabeka Falls Railway Company has just started the work of power development from the Kam river, and has at the present time a big camp on their land on that river some miles above Westfort. Some five hundred acres in all are being cleared and a gang of thirty men is now at work under the direction of James Tonkin.

### Fort Frances Power Scheme.

Work on the development of the water power at Fort Frances has been resumed. Over one hundred men are now engaged and more are expected to come shortly, so that operations will be rushed from now until completion of the work. Under favorable conditions this should be completed inside of one year. Pulp mills, saw mills and flour mills will be erected in the coming spring.

### Profit-Sharing.

During the past week the B.C. Electric Railway Company has distributed their annual bonus. Every employe who has been with the company one year or more, from the highest official to the lowest, will benefit by the profit-sharing plan, adopted by the company. There has been distributed in all $45,000 here, in Vancouver and in Westminster, each employe receiving $66.78 as his share.

### Hamilton Street Railway.

The Dominion Power & Transmission Co., of Hamilton, took out a permit on Monday for the erection of car barns and repair shops, to cost, with equipment, in the neighborhood of $75,000. The company started 100 men to work preparing the grounds for the new building. This is only the preliminary step in the work, which the company claims will cost $150,000 before its completion. The building will be 145x300 feet, and will have accommodation for 150 cars.

## Dams for Power Purposes.

Tenders have been received by the Department of Public Works for the construction of a dam at the foot of Lake Temiskaming, which will permit of the storage of 27,878,400,000 cubic feet of water in that lake, to be used during the dry season to maintain a sufficient supply of water in the Ottawa river for power purposes. Later on dams will also be built on Lake Kippewa, Lake Quinze, Barriere River, Lake Expanse and on Askikwagi Lake, for a like purpose.

## Brockville's Light Plant.

Brockville's light and power department has just closed its fiscal year. The statement shows that the gross profits for the past eight years were $13,404.53, and the net profit for the same period $9,977.35. During that period reductions to the consumer in the way of illuminating gas had been made from a rate of $2 per thousand net in 1900 to $1.12½ in 1908, and fuel gas was reduced from $1.25 per thousand to $1.12½. The price of electric current per k.w. hour net was lowered from .20 to. .10. The profit for the past year was $8,539,58.

## Canadian Asbestos Best.

According to the annual report of the United States Geological Survey, there was a marked decrease in the production of asbestos in the United States in 1907, the output amounting to but 653 net tons (of 2,000 lbs.) valued at $11,899, as compared with 1,695 net tons, valued at $28,565 in 1906. The cause of the decline is found in the better quality and greater abundance and accessibility of the Canadian asbestos, which completely dominates the industry of tne United States. Nearly all the output of asbestos in 1907 came from the Sall Mountain and Hollywood Mountain, of Georgia, which is the only state that furnished asbestos for the market in 1907, and nearly half of the quantity produced was exported. The largest output in the history of the industry in the United States was in 1905, when the product amounted to 3,100 tons.

## Power Equipment, Coristine Building, Montreal.

The power plant of the Coristine building, Montreal, has recently been enlarged by the addition of a battery of two 250 horse-power Babcock and Wilcox boilers, one 300 horse-power Wheelock engine, belted to a 200 k.w. Northern D.C. generator. This addition was necessitated by the fact that the power required for the new Coristine buildings, on St. Paul and St. Nicholas Streets, is to be supplied from the central station in the old building. The plant, when completed, will supply eighteen hundred Incandescent lights, nine Otis elevators, besides the power required for the James Coristine Company in manufacturing. The plant is also equipped with one 500 horse-power Cochrane heater and Blake duplex pumps. The electrical apparatus was installed by the Fred Thompson Company, Montreal, while the Ross & Greig Company, Montreal, installed the pipe work.

## Winnipeg Power Scheme.

Winnipeg's council decided recently to go ahead with the construction of a plant situated on the rapids of the Winnipeg river, 40 miles east of the city, where electric power will be developed and brought to the city. Half a million dollars have already been spent, and contracts will be let at once for the expenditure of a million and a half dollars, to be followed next year by contracts to aggregate another million dollars.

Sealed tenders addressed to the Board of Control, Winnipeg, Canada, will be received to Monday, 28th December, for the construction of the general works, and for the supply and erection of various portions of a transmission line between Point du Bois and Winnipeg. Plans, specifications and form of tender, may be obtained at the Power Engineer's office, Carnegie library building, Winnipeg. Specifications may also be seen at the office of Smith, Kerry & Chace, Confederation Life building, Toronto. Individual tenders will be received for : 4, general works at Point du Bois ; 14, erection of transmission line ; 15, steel towers ; 17, electric transmission cable. As a further alternative, tenderers may include or group together one or more of the above items, providing that they have also tendered for the individual items of such group.

## Oil in Alberta.

From the American boundary on the south, to Lake Athahasca, several hundred miles north of Edmonton, there are signs that the underlying rock is saturated with petroleum, and that in many places there are immense accumulations of natural gas.

Along the Athabasca river the deposits appear at or near the surface. Natural gas and oil pour out of the river bank and the bed of the stream, and the famous "tar sands," which are simply sand covered with the residue of the petroleum which has run out and evaporated, stretch for over 100 miles.

Near Pincher Creek some successful oil and gas wells have been bored, and the Western Oil & Coal Consolidated, who have leased for oil boring purposes 13,000 acres of the most promising land surrounding that town, are now actively engaged in drilling for both oil and natural gas.

Ds. I. C. White, State Geologist of West Virginia, and one of the most successful oil and gas geologists on the continent, recently examined the sections where this company's outfits are drilling. He says that the character of the underlying rock and the way the layers are tilted provide the conditions par excellence for the accumulation of oil and gas in commercial quantities. He regards it as almost certain that gas will be found about half a mile northeast of Pincher Creek, and oil a little farther away.

Western Oil & Coal Consolidated have secured a charter for lighting Pincher Creek with natural gas, and this and other western towns will soon enjoy cheap light and fuel.

## CATALOGUES.

POWER EQUIPMENT—Stock list of machine tools and power equipment from H. W. Petrie, Toronto.

BELTING—Price list of belting from Sadler & Haworth, Montreal and Toronto, manufacturers of oak-tanned belting.

TRANSFORMERS—From Canadian Westinghouse, Hamilton, bulletin describing the transformer and its construction.

AIR COMPRESSORS—Bulletin No. 4564 from General Electric Co., Scheuectady, describing centrifugal air compressors for air blast and exhauster service.

SWITCHES—Catalogue No. 4 from Devoe Electric Switch Co., 157 Craig St. West, Montreal, describing and illustrating their types of single and double throw switches.

PRESSED STEEL PULLEY—Pamphlet from Philips' Pressed Steel Pulley Works, 4th St. and Glenwood Ave., Philadelphia, including price list of pressed steel pulleys.

A. C. GENERATORS—Bulletin No. 1038 from Allis-Chalmers-Bullock, Montreal, describing various types, details of construction, tables of sizes with speeds, etc., are given and numerous illustrations of instalations.

TURBINE PUMP—Bulletin No. 1612 from Allis-Chalmers-Bullock, Montreal, describing fully the Allis-Chalmers oil pressure hydraulic turbine governor. The action of governor and oil pressure system is given in detail.

OIL FURNACES—Illustrated bulletin from Francis Hyde & Co., 31 Wellington St., Montreal, describing the King oil heater, King portable rivet furnace, King flue welding furnace and King crucible furnace.

THERMIT—Application of thermit to foundry practice, from Goldschmidt Thermit Co., 90 West St., New York. It gives the methods used to avoid piping in steel ingots, and shows the methods of applying thermit.


# Condensed Advertising

### RATES

One insertion—25c. for 20 words ; 1c a word for each additional word.

Yearly rate—$2.50 for twenty words or less ; 10c. a word for each additional word.

### TO INVESTORS.

ONE OF THE PROGRESSIVE Western Contracting Companies last year paid 40% cash from its manufacturing profits. The company is now extending to meet the heavy demand on the coast and now offers a small block of its stock at par. For full particulars write Box 1, POWER HOUSE, Toronto.

### DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Machine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. The "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

### MISCELLANEOUS.

BETTER, CHEAPER, SAFER LIGHTING.—The Pitner System of Gasoline Lighting is the best system yet produced for lighting a store, hotel or public building. In cities and towns Pitner Systems are used because of the superior quality and quantity of light obtained for small cost. They are just as successful in any village or country place. A small outlay secures a complete and independent Pitner lighting plant. Free illustrated booklet and full particulars on request. The Pitner Lighting Co., Limited, Toronto, Canada.

# WATER POWER

**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

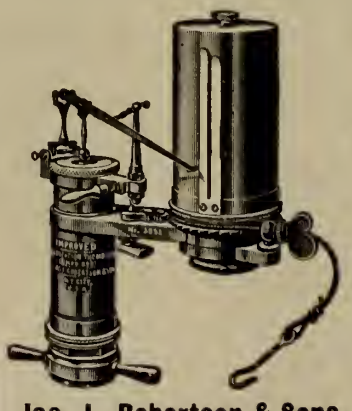
658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**

**TECHNICAL BOOK DEPARTMENT**

**10 Front St East - - Toronto**



**POWER PROFIT is MONEY EARNED**

Every Engine will do more work without extra cost when trued up with a

**ROBERTSON-THOMPSON INDICATOR**

Up-to-date in construction —sold at a moderate price and on easy terms if desired.

**Jas. L. Robertson & Sons**

**38 Warren St., New York**

# Less Friction, No Waste, 50% Greater Economy

**These are the infallible results of using any good cup grease in combination with the**

# "PHILADELPHIA" GREASE CUP

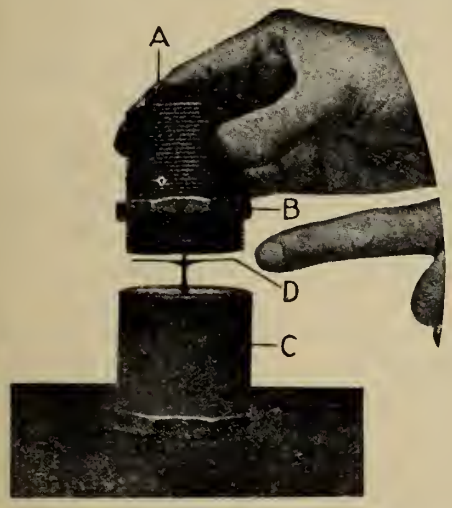



FIG. 1.
Method of filling: Screw the cup into place before filling; unscrew and remove A; fill C even full with grease, holding A as shown in cut (with locknut B and disc D in position shown) screw it into C to the position illustrated in Fig. 2, or not to exceed one-quarter its length.

¶ It is a thoroughly demonstrated fact that in most cases where liquid oil is used as a lubricant there is more waste than lubrication. Grease, or rather "solidified oil," is a much more efficient lubricant, if you can apply it properly. The Philadelphia Grease Cup overcomes every difficulty in applying grease to the journals by means of a compressed air feed. It keeps a constant film of grease between the frictional points — practically eliminating the friction. The solid character of the grease does away with all possibility of waste, and the perfect lubrication thus afforded enables you to get the best possible work out of your machines.

FIG. 2.
Shows cup filled with grease, the upper part screwed into place. This will suffice for a run of from one week to a month, according to the nature of the journal. In the bottom of the cup is a funnel which draws the grease to the centre so that if the grease runs low and the cup cannot be at once refilled, the surplus in the funnel will be sufficient to lubricate the journal until the refilling is done.

## ALL PRACTICAL ENGINEERS

are interested in this cup. The assertions we make are fully backed up by indisputable proof. We don't expect you to take us on trust. We want to SHOW you. We expect all practical engineers who see this advertisement to write us a postal asking for full particulars, whether they are in a position to instal our cups or not. This cup is a good thing for engineers and manufacturers alike, and we want them all to know it.

*WRITE FOR PARTICULARS TO-DAY.*

## The Peterborough Lubricator Mfg. Co. Limited

**Factory:**
**PETERBORO, CANADA.**

**Sales and Demonstration Rooms:**
**127 BAY ST., TORONTO, CANADA.**

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

### Air Chambers.
Hercules Float Works, Springfield, Mass.

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Dressings.
Stephenson Mfg. Co., Alhany, N.Y.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
Canadian Fairbanks Co., Montreal.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

### Boiler Cleaner.
Canada Chemical Mfg. Co., London.

### Boiler Feed Regulators.
Standard Engineering Co., Toronto.

### Boiler Mountings.
Standard Engineering Co., Toronto.

### Boilers.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Castings, Brass.
Hercules Float Works, Springfield, Mass.

### Combustion Recorder.
Canadian Instrument and Testing Co., Montreal.

### Condensers.
Goldie & McCulloch Co., Galt.

### Consulting Engineers.
De Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.

### Coppersmiths.
Hercules Float Works, Springfield, Mass

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Dynamos.
Electrical Maintenance & Repair Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Electrical Repairs.
Electrical Maintenance & Repair Co., Toronto.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Automatic.
H. W. Petrie, Toronto.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

### Engines, Gas and Gasoline.
Gas & Electric Power Co., Toronto.
J. DeClercy, C.E., Montreal.

### Engines, High Speed, Steam.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Simple and Compound.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Vertical.
H. W. Petrie, Toronto.

### Exhaust Heads.
Standard Engineering Co , Toronto.

### Feed Water Analyser.
Canadian Instrument and Testing Co., Montreal.

### Feed Water Heaters
Goulds Pump Co., Montreal.

### Floats, Seamless, Copper.
Hercules Float Works, Springfield, Mass

### Gas Producer Plants.
Gas & Electric Power Co., Toronto.

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Grease Cups.
Peterhoro Luhricator Mfg. Co., Peterboro

### Hangers.
Goldie & McCulloch Co., Galt
Waterous Engine Works Co., Brantford.

### Heaters.
Goldie & McCulloch Co., Galt.

### Heating and Ventilating Apparatus.
Sheldons Limited, Galt.

### Indicators, Steam Engine.
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Mechanical Stokers.
Jones Underfeed Stoker Co., Montreal.

### Mill Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Motors.
Electrical Maintenance and Repair Co., Toronto.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Pipe Threading Tools.
Borden-Canadian Co., Toronto.

### Planimeters.
Jas. L. Robertson & Sons, New York.

### Plate Work.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.
Goldie & McCullock Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford.

### Power Transmission Machinery.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Pump Governors.
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Reducing Wheels.
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt

### Shafting.
Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Union Drawn Steel Co., Hamilton.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Special Machinery.
Electrical Maintenance and Repair Co., Toronto.

### Steam and Oil Separators.
Standard Engineering Co., Toronto.

### Steam Pumps.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

### Steam Specialties.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.
Sheldons Limited, Galt.
Standard Engineering Co., Toronto.

### Steam Traps.
Sheldons Limited, Galt.

### Stocks and Dies.
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Switchboards, Light and Power.
Electrical Maintenance and Repair Co., Toronto.
Gas & Electric Power Co., Toronto.

### Tanks, Oil.
Goldie & McCulloch Co., Galt
Jenckes Machine Co., Sherbrooke, Que.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Turbine Water Wheels.
Canadian Fairbanks Co., Montreal.
Jenckes Machine Co., Sherbrooke, Que.
Jas. Morrison Brass Mfg Co., Toronto.
J. C. Wilson & Co., Glenora, Ont.

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Venetian Grates.
J. De Clercy, Montreal.

### Watt Meters.
Gas & Electric Power Co., Toronto.

### Wood Split Pulleys.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.

## ALPHABETICAL INDEX TO ADVERTISERS


**A**

American Industrial Pub. Co ..... 43
American School of Correspondence ..... 43
Andel & Co., Theo ..... 7

**B**

Beaubien, De Gaspe ..... 48
Borden-Canadian Co ..... inside front cover

**C**

Canada Chemical Mfg. Co ..... 7
Canada Metal Co ..... 45
Canadian Association of Stationary Engineers ..... 43
Canadian Instrument and Testing Co ..... 4

**D**

Death & Watson ..... 48
De Clercy, Jules, C.E ..... 47, 48

**E**

Electrical Maintenance & Repair Co ..... inside back cover

**F**

Francis, Walter J ..... 48

**G**

Garde, John, & Co ..... 47
Gas & Electric Power Co ..... 2
Goldie & McCulloch Co ..... 8

**H**

Hercules Float Works ..... 47

**J**

Jenckes Machine Co ..... 3
Jones Underfeed Stoker Co ..... 1

**K**

Kilmer & Pullen ..... inside back cover

**Mc**

McLaren, D K., Ltd ..... 5

**M**

Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

**P**

Packard Electric Co., Ltd ..... 48
Parke, Roderick J ..... 48
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 6
Peterboro Lubricator & Mfg. Co ..... 41

**R**

Robertson, Jas. L., & Sons ..... 40
Robertson, J. M ..... 48

**S**

Sadler & Haworth ..... 3
Sammett, M A ..... 48
Shanly, J. M ..... 48
Sheldons Limited ..... 7
Sight Feed Oil Pump Co ..... 1
Standard Engineering Co ..... 3
Stephenson Mfg. Co ..... 47
Schuchardt & Schutte ..... 47

**T**

Taylor, Jas ..... 48
Toronto Plate Glass Importing Co ..... 47

**W**

Waterous Engine Works Co ..... 1
Wilson, J. C., & Co ..... 47

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

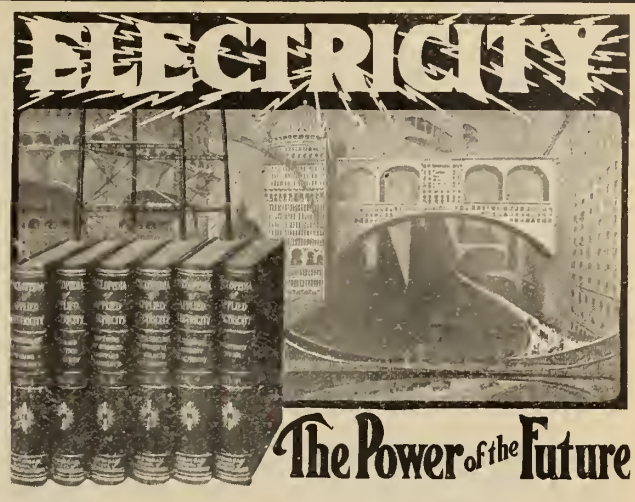
The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**

**Executive Secretary**

**MT. HAMILTON, - ONT.**






**The man who is fitting himself for the field of electricity to-day, is facing an opportunity that is almost limitless.** *The power of the future is electricity,* **and in this branch of science will be found the greatest possibilities for advancement.**

**The standard reference work of the up-to-date Electrician, Electrical Engineer, and all allied professions is the**

## CYCLOPEDIA *of* APPLIED ELECTRICITY

This complete, specialized work comprises 3,000 pages of authoritative, up-to-date information. It treats of twenty-three general subjects. Its detailed index includes over 4,000 different topics. A careful revision has just been made, page for page. Every topic previously covered has been brought right down-to-date. Six Volumes, page size 7 x 10 inches. 2,000 special photos, sections, diagrams, etc., indexed and ready for reference.

In proof of its up-to-dateness, it is only necessary to mention that foremost among the subjects treated are Dynamo-Electric Machinery, Alternating Current Machinery, Wireless Telegraphy, Wireless and Automatic Telephony, Storage Batteries, Power Station and Transmissions, Telautograph, Electric Lighting and Railways, Electric Wiring, Telegraphone, etc.

## OUR LIBERAL SELLING OFFER

Upon receipt of coupon we will send you a set of Cyclopedia by prepaid express, without deposit or guarantee of any kind. Keep the books five days, examine them carefully, give them every possible test. We want you to be the judge—you are under no obligation whatever. If you decide the books are not what you want, advise us and we will have them returned at our expense. If you retain them send $2.00 within five days and $2.00 every thirty days until you have paid the special price of $18.60. Regular price $36.00.

**BRIEF LIST OF CONTENTS.**

**Management of Dynamos and Motors, including the Location and Remedy of Troubles, such as Sparking at the Commutator, Heating, Etc.; Power Stations; Central Station Engineering; Central Station Design; Power Transmission; Alternating Current Generator; Synchronous Motor, Induction Motor, Transformer, Rotary Converter, Frequency Changer, Etc.; Theory, Calculation, Design and Construction of Generators and Motors; Types of Dynamo and Motors: Elevators; Direct Current Motors; Electrical Measurements; Electric Lighting, including Arc and Incandescent Lighting, Nernst Lamp, Cooper-Hewitt Lamp, Osmium Lamp, Etc.; Electric Railways, including Third Rail System, Multiple Unit Control, Electro-Pneumatic Control, Alternating Current Motors, Etc.; Single-Phase Electric Railway; Electric Welding; Mercury Vapor Converter, Storage Batteries, including Charging and Discharging Troubles and Their Remedies, Tests for Impurities, Etc.; Electric Wiring; Electric Telegraph: Wireless Telegraphy; The Telautograph; Telephony, includes Instruments, Lines, Exchanges, Common Battery Systems, Operation, Maintenance; Automatic Telephone; Wireless Telephony; Telegraphone, Etc.**

**FREE** Order promptly and we will include as a monthly supplement one year's subscription to the

## TECHNICAL WORLD MAGAZINE,

A regular $1.50 monthly, presenting twentieth century scientific facts in plain English. Latest discussions on timely topics in science invention, discovery, industry, etc. The strongest serial of the season, "WHO OWNS THE EARTH" begins with the January issue. *Just Mail the Coupon.*

**AMERICAN SCHOOL OF CORRESPONDENCE**
**CHICAGO, U.S.A.**

## FREE OFFER COUPON

*Fill in, clip and mail to-day.*

**American School of Correspondence:**

Please send Cyclopedia of Applied Electricity for FREE examination: also T.W. for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60, otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

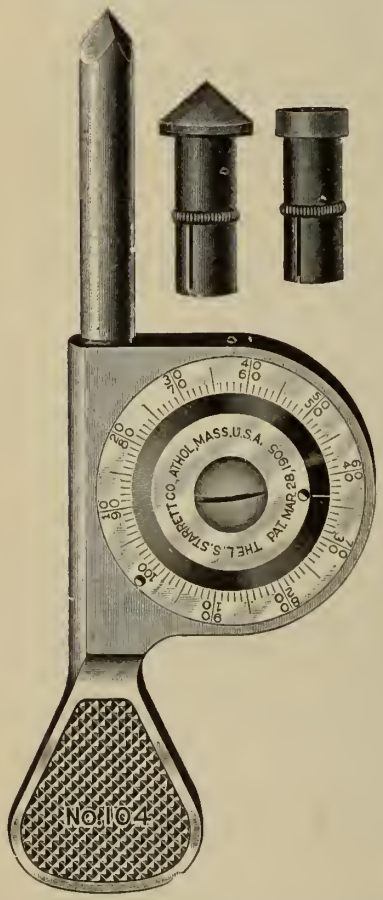
POWER HOUSE—12—08

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**



**STARRETT RECISTERING SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**

"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

Start in TO-DAY to earn one of these Handy Tools.

**THE POWER HOUSE, 10 Front Street East, Toronto**

# IMPERIAL GENUINE BEARING METAL

## For Engines or Machines of Heaviest Duty

None Better Made

**Contains no Lead and Hardness.**

**Great Toughness Will not Shrink**

**This metal is made for bearings carrying extremely heavy loads and is specially made by us for this work.**

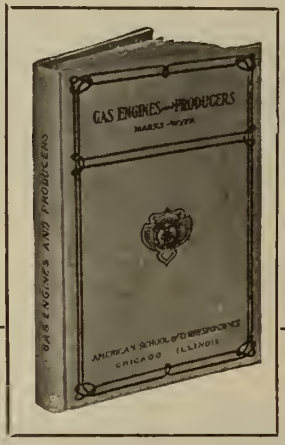
## The CANADA METAL CO. Ltd.

TORONTO, ONTARIO

# Engineers! Wake Up!!

## Make a noise like ENERGY!!!

Then sit back and think over this proposition. You have in your hands one of the best Engineers' papers published. It's full of meat from cover to cover and it only costs you a dollar a year. We want to tell you that we will send either of the two following books—which would cost you a dollar to get any other way—to every subscriber who sends us in one new, paid-up yearly subscription to The POWER HOUSE.

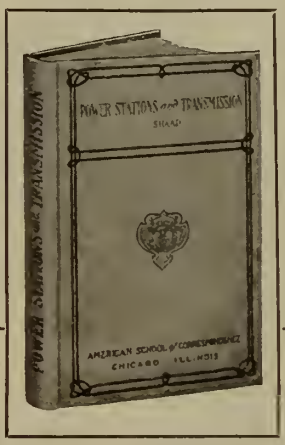



**Gas Engines and Producers**

**By Lionel S. Marks, S.B., M.M.E.**

Assistant Professor of Mechanical Engineering, Harvard University, American Society of Mechanical Engineers, and **Samuel S. Wyer**, Mechanical Engineer, American Society of Mechanical Engineers. 160 pp., 90 illus. Cloth binding, Embodying the latest information in this rapidly developing field. Of immense practical value to all Engineers, Machinists, power-plant owners or managers, etc.,—in fact, all interested in efficient and economical power production.

**Price.....$1.00**




**Power Stations and Transmission**

**By George C. Shaad, E.E.**

Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. 176 pp., 43 illus. Cloth binding. A manual for Electrical Engineers and Electrical Workers in general. It represents the accumulation of years of practical experience by the best authorities, and should be in the hands of every worker in the great field of electricity and of every other practical man, no matter what his business, who is interested in the development of electrical power.

**Price.....$1.00**

## Now you're done thinking . . . . . ACT!!!

**Send us in a new subscription. Just try one or two of your engineer friends—tell them how well you like the paper and you will be surprised how easy it is to get the subscription. Tell us which book you want and we'll send it by return mail. . . . . .**

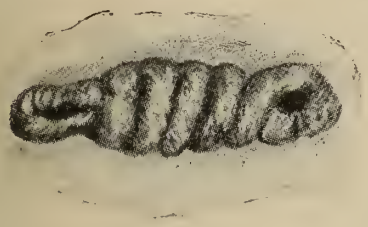
# THE POWER HOUSE

## 10 Front Street East - - - Toronto

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

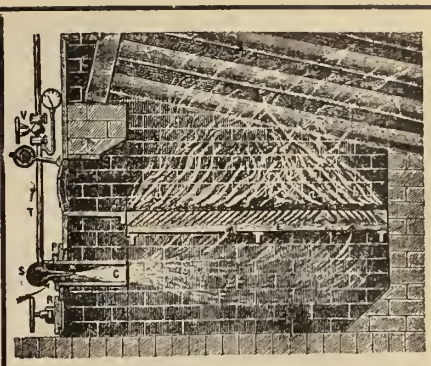
If it's Floats you want you'll be wise to specify

**Hercules**
**Seamless Copper**
**FLOATS**

Positively the best floats made—
Over 250,000 in use to-day

Our Catalog "C" will convince you. Write for a copy to-day.

**Hercules Float Works**
P.O. Box 396. Springfield, Mass.



# Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

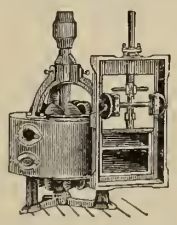
Saves 20% to 50% in your fuel bills.

*For Particulars Apply*

**J. de Clercy, C.E.**
**62 Ontario St., West**
MONTREAL

**OPAL GLASS TILING**
FOR WALLS OF
**MACHINERY AND POWER HOUSES**
Most approved material.
**TORONTO PLATE GLASS IMPORTING CO'Y.**
PLATE AND WINDOW GLASS
135 to 143 Victoria St., - Toronto

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effiei-ency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

Write for descriptive cat-alog.

**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.

## DON'T LET $4.80

stand between you and healthy, long-lived, dependable belts. Ask your dealer for a box of **STEPHENSON** Bar Belt Dressing, and see how quickly and gratefully your belts will respond to good treatment.

The results will delight your heart and your check book.

Be sure our registered Trade Mark—The Man with the Cog Wheel Face—is on each Pound Stick.

Don't confuse the Brands:—

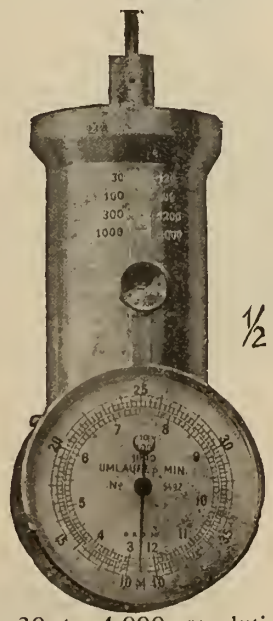
**RED** Label Brand for Leather Belts
**GREEN** Label for Rubber and Canvas.

**$4.80 for a 12-lb. Box**
**Of Dealers everywhere, or**

**Stephenson Manufacturing Co.**
ALBANY, N. Y.

## HAND TACHOMETERS

No watch required for readings.



½ full size.

Registers from 30 to 4,000 revolutions per minute **without using a watch.**

**Schuchardt & Schutte**
**91 Youville Square, MONTREAL**
**New York, London, Shanghai, Berlin, Vienna, Stookholm, St. Petersburg, Copenhagen, Budapest**

# PROFESSIONAL DIRECTORY

**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc., Assoc. A.I.E.E.
L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**J. M. SHANLY**
M. Can. Soc. C. E. M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**JULES DE CLERCY, M.E.**
GAS ENGINEER
Expert knowledge of all classes of Engines and Producer Plants. If you are thinking of installing a Gas Engine or Producer Plant write me. If your plant is not working satisfactorily I can help you.
62 Ontario St. West, - MONTREAL, QUE.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327
702 Canadian Express Bldg., MONTREAL

**RODERICK J. PARKE**
A.M. Can. Soc. C.E. A.M. Amer. Inst. E.E.
Consulting Electrical Engineer
INDUSTRIAL STEAM AND ELECTRIC POWER PLANTS DESIGNED, TESTS, REPORTS
205 Yonge St., Bank of Toronto Bldg., TORONTO
Long Distance Telephone—Office and Residence

**JAMES TAYLOR**
(Cert: Chief Engineer)
**Consulting and Superintending Marine Engineer.**
Specifications, Designs, and Plans prepared of Machinery for Steam Yachts, Launches, Barges, Trawlers, Tugs, Cargo and Passenger Steamers. Vessels surveyed for Damage or otherwise and reported on. Steamers, contracted for and superintendence conducted in Canada or abroad. Correspondence invited. Appointments by arrangement.
GRANT ST., NEW GLASGOW, NOVA SCOTIA

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Estimates, Reports, Plans and Specifications. Supervision of Power. Lighting and Railway Installations.
Liverpool London and Globe Bldg., MONTREAL

**Incandescent Lamps**

*Packard*

The Old Reliable
Used Everywhere

*All Standard Candle Powers and Voltages.*

**The Packard Electric Co., Limited**

Head Office and Works: St. Catharines, Ont.

Branch Offices:
Montreal
Winnipeg

A VERY MERRY XMAS

*A Very Merry Christmas.*

*A Happy and Prosperous New Year.*

We wish to thank you, our many FRIENDS and CUSTOMERS, for the hearty support you have given us during the past twelve months, and hope to enjoy the privilege of your trade for the coming season.

**The Electrical Maintenance & Repairs Co.**

**162 Adelaide Street West, - TORONTO, ONT.**

**PHONE MAIN 3419**

# The General Electric Co. of Sweden

**400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.**

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

**SOLE CANADIAN AGENTS:**

**KILMER & PULLEN,** 505 McKinnon Building, TORONTO

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

## *Thousands of Dollars are Saved*

every year by the wise selection of RELIABLE Steam Good

The good engineer knows it to be false economy to instal such goods because they're cheap. Usually they waste steam or cause trouble and annoyance. The effect not always lasting for a day only, but frequently is allowed to continue for weeks, each succeeding week increasing the loss sustained by the user.

***Full Weight and Substantially Made Goods Pay***

***The Kind We Make***

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

Valves of All Kinds in Iron and Brass

Iron and Brass Cocks—Steam, Marine and Asbestos Packed

J. M. T. Improved Y Blow-off Valve, with renewable seat

Steam, Vacuum and Combination Gauges

Revolution Counters

Engineers' Clocks

Improved Recording Gauges

Steam and Hot Water Thermometers

# Engineers' Supplies

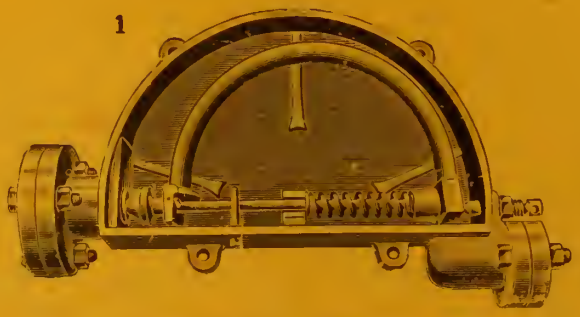
## and Steam Specialties

*Improved*

***J.M.T. Injector***

operates under the widest range of pressures.

SIMPLE
EFFICIENT
RELIABLE



***The "HEINTZ" Steam Saver***

Controlled by temperature, operates under any pressure, can be placed in any convenient location, contains few parts which are easily accessible to.

The ***Heintz Trap*** combines great efficiency and durability, has large capacity and operates at a variation at one degree of temperature.

*Booklet upon request*

***J.M.T. Valves***

They require no introduction. Used anywhere where a good valve is required.

## The JAMES MORRISON BRASS MFG. CO., Limited

**93-97 Adelaide Street West** **TORONTO**

CIRCULATES IN EVERY PROVINCE OF CANADA.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. I. Publication Office, Toronto — January, 1909 No. 5

No. 6 "Beaver" Die Stock

Let us send you a "Beaver" Die Stock on

# Ten Days' Free Trial

and if it is not every bit as superior to ordinary Die Stocks as we claim it is, we will take it back without charging you a cent.

## *Threads four sizes of pipe without changing dies*

¶ Just figure out what a lot of time you can save with a "Beaver" when you have any pipe-threading to do.

¶ Instead of hunting out a different set of dies for each size of pipe, you can adjust your "Beaver" to any of the four sizes within its range in a "jiffy."

¶ The threads cut by a Beaver are always absolutely accurate and properly tapered.

¶ No danger of stripping threads when you are using a "Beaver" because the cutting dies are always in perfect alignment.

**Number 6 "Beaver" cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by a single cam, so constructed as to move one set of dies out of the way while the other set is in use.**

**Number 2 "Beaver" cuts 1-in., 1¼ in., 1½-in., 2-in. pipe. One boy can successfully operate this tool.**

**Number 4 "Beaver" cuts 2½-in., 3-in., 3½-in., 4-in. pipe and a boy can operate it with a ratchet handle.**

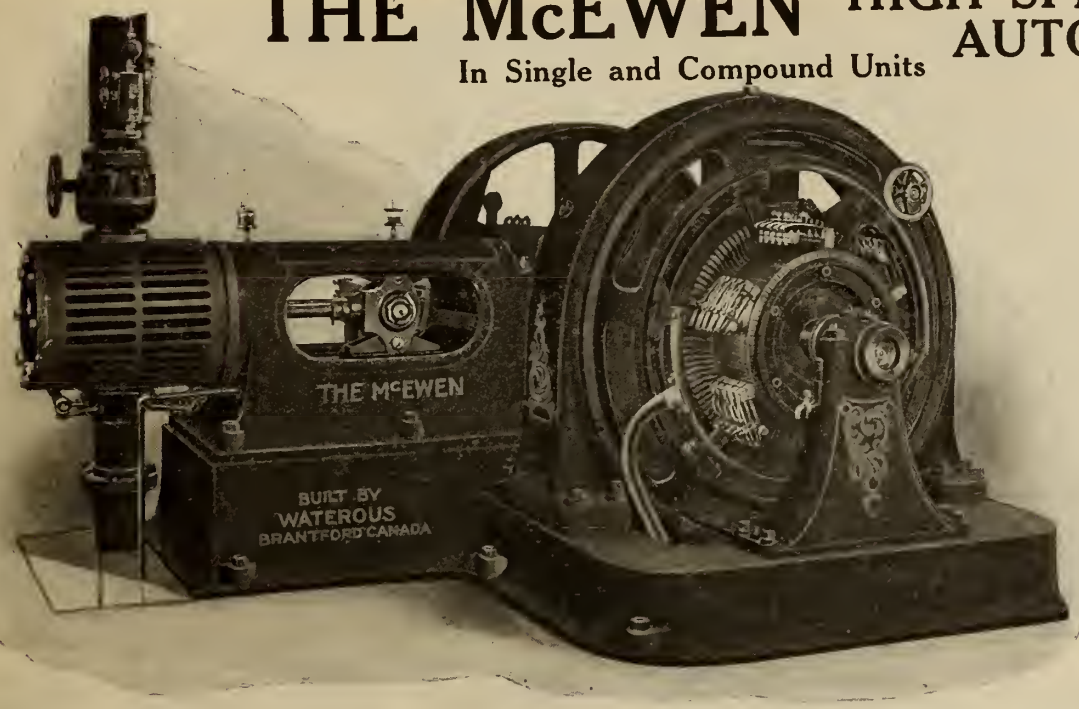
## Don't Delay—Write NOW

# Borden-Canadian Company

**66 Richmond Street East, Toronto, Ont.**

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units




Specially Suited for Direct Connected Electrical Works.

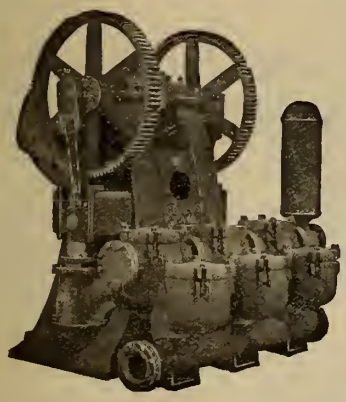
Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

BRANTFORD, - ONTARIO

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver



## On Account

of their Extremely Low Cost of Operation and the Small Amount of Attention Required

## Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

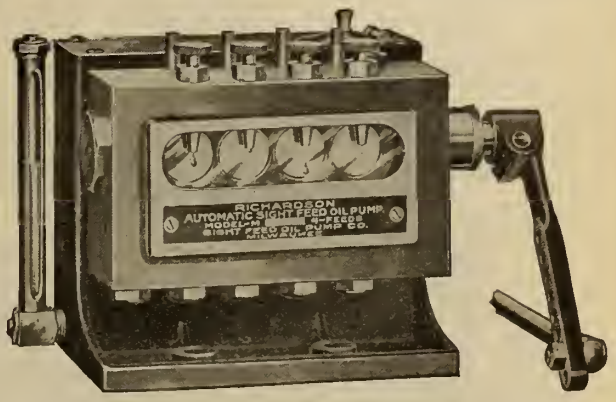
## Goulds Pump Co.

Coristine Bldg., Montreal

Phone Main 1054

*Works - - - - - Seneca Falls, N.Y.*

## The Model "M" Method




You would not shoot at a flock of birds with a rifle! You would not sow seed with a shovel! A rushing stream of steam will not efficiently charge itself with oil that is introduced spasmodically in quantities, and the oil that is introduced is only partially effective; a large percentage dodges right on thru the engine and is lost.

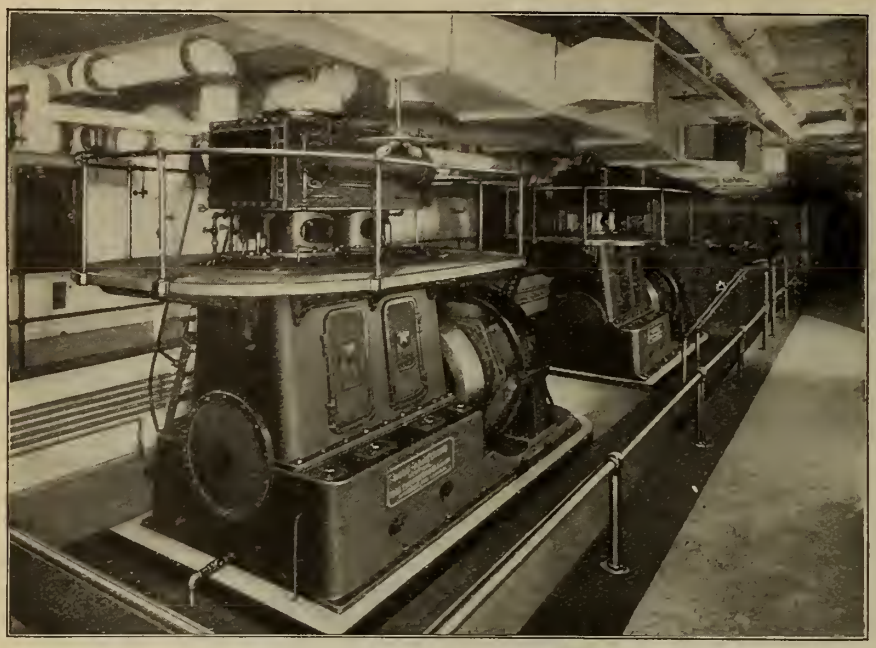
The Model "M" Method is to introduce a less amount of oil in very small quantities at every engine stroke. It is an interesting story, and we would like to tell you all about it.

Bulletin No. 109-L.

Manufactured by

## SIGHT FEED OIL PUMP CO.

MILWAUKEE, WIS., U.S.A.



# HIGH SPEED VERTICAL ENGINES

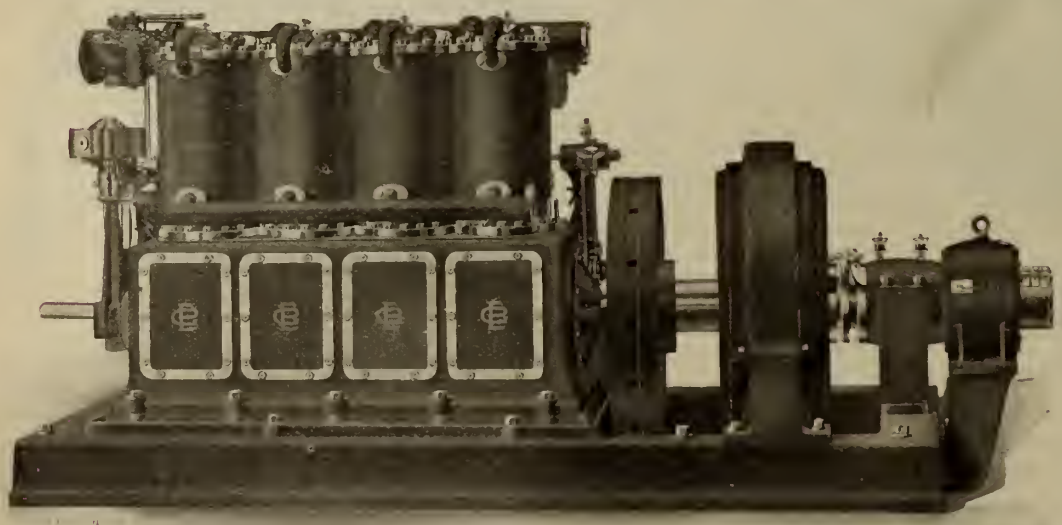
of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES { Traders Bank Building, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
Union Bank Building, WINNIPEG ; J. F. Porter, Manager

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants  Pressure Gas Plants



Engine direct connected to alternators, guaranteed to run in parallel successfully.

Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.
Stair Building, Bay Street - TORONTO

# HORIZONTAL TUBULAR BOILERS

## FOR MEDIUM OR HIGH PRESSURE

We build them in all sizes from 10 h.p. up to 250 h.p. and larger.

High pressure tubular boilers from 80 to 250 h.p. our specialty.

Furnished complete with fixtures and fittings for setting either singly or in batteries as desired.

High Pressure Tubular Boiler

**Our new Boiler Catalogue is interesting. Send for Copy**

## The Jenckes Machine Company, Limited

**GENERAL OFFICES: Sherbrooke, Que.**

**WORKS: Sherbrooke, Que.; St. Catharines, Ont.**

**SALES OFFICES: Sherbrooke St. Catharines Cobalt Vancouver Halifax**

## SADLER & HAWORTH

## Oak Leather Belting

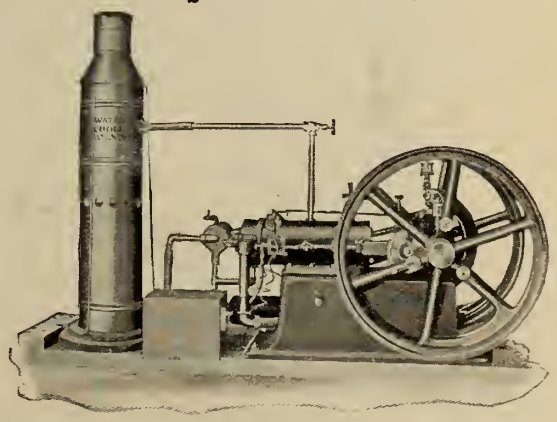
## WHEN A LEATHER BELT

*Is not satisfactory it is a costly nuisance. You cannot afford to make mistakes. You run no risk when you buy*

## "CLIMAX"

## GAS and GASOLINE ENGINES

### 1½ to 25 H.P.



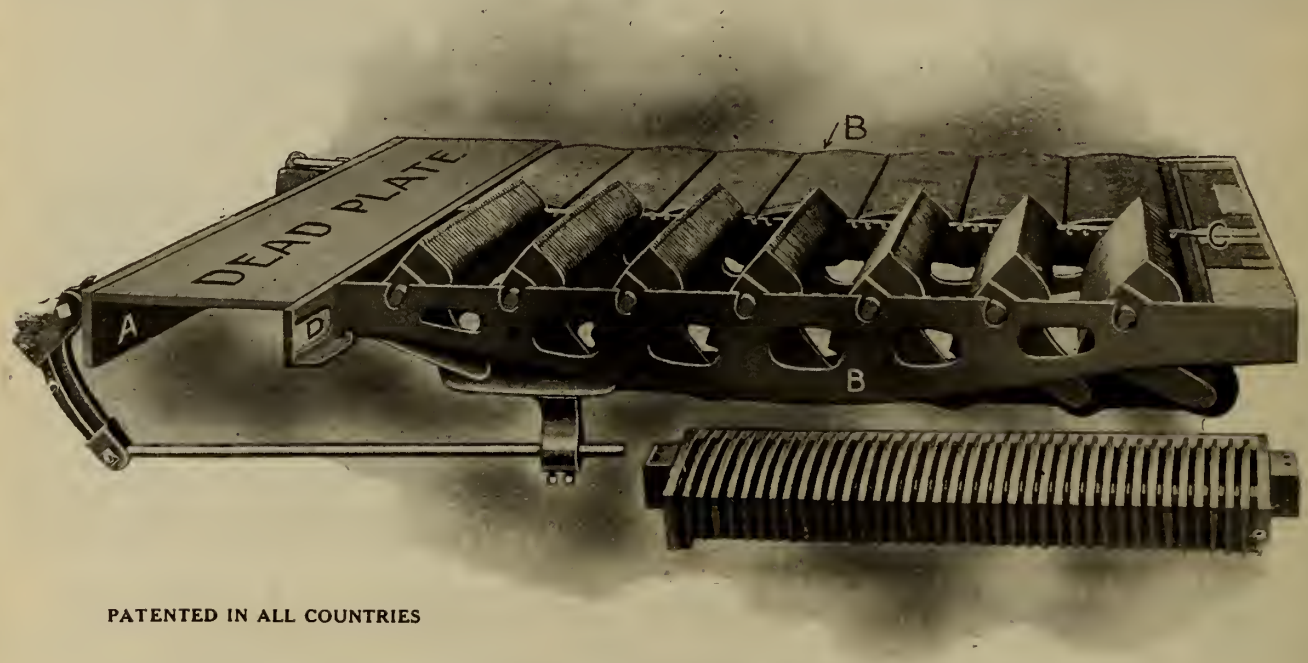
If interested it will pay you to write for our Catalogue

## Goold, Shapley & Muir Co.

Limited

**BRANTFORD - CANADA**

# The Improved Cyclone Shaking and Dumping Grate




PATENTED IN ALL COUNTRIES

The section of the grate shown nearest the reader is in the Dumping Position; that in the rear is shown level, or ready for the fire. In shaking, the bars are rocked backward and forward slightly, so as to sift the fine ashes through only.

## What we claim for the Cyclone Shaking and Dumping Grate.

A Perfect Shaking Grate. The fire always clean.

A Perfect Dumping Grate. Clinkers Dumped without pulling them out on the floor.

Greater Air Space than any other grate on the market; therefore—perfect combustion.

Perfectly balanced; therefore easy to operate in shaking or dumping.

Will burn any kind or size of coal or wood on the market; either hard or soft, lump or slack, good or bad, therefore—great economy.

Great simplicity of design and strength of parts; therefore—long life.

Easily and quickly installed; therefore—no shut down of plant necessary. No expensive changes in the brickwork needed.

**Is being used by nearly all of the larger concerns in Canada.**

## EXTRACTS FROM SOME LETTERS WE HAVE RECEIVED:

The Ellis Furniture Co.,
Ingersoll, Ont.

Canadian Steam Boiler Equipment Co., Limited.

Dear Sirs: — They have proven satisfactory in every respect, being very economical, very durable and as we consider, moneymakers for us as we have saved considerable in our fuel account for the first four months of this year. We have no hesitation in recommending them to all users of boilers.

Yours truly,
THE ELLIS FURNITURE CO.,
G. C. Ellis.

---

Cornwall and York Cotton Mills Company, Limited,
Saint John, N.B., February 24, 1908.

Canadian Steam Boiler Equipment Co., Limited.
Toronto, Ont.

Dear Sirs:—Will you kindly send us another set of your Shaking Grate Bars so that we can complete the equipment of our boilers in the York Mill. The other sets that we have in service have given us most excellent satisfaction and we are very highly pleased with them. The best evidence I can give you of this is the fact that we are now giving you the order to complete the last boiler in the mill that has not your bars under it. The bars in service have borne out all you claim for them and so far do not give any sign of wear, and I think from the fact that they have such an unusually large area of air openings that the bars should be practically everlasting, with ordinary care.

Yours truly,
JOHN B. CUDLIP,
Manager.

The Toronto Paper Mfg. Co.,
Georgetown, February 29th, 1908.

The Canadian Steam Boiler Equipment Co., Limited,
Toronto.

Gentlemen,—We have much pleasure in adding our testimony to the value of your Cyclone Grate Bar for hand-fired steam boilers. We had them in use for several years and were induced to take them out and put in mechanical stokers. These latter increased our coal consumption nearly ten per cent., so we took them out and put back your Cyclone Bars again.

Yours truly,
BARBER BROS., LIMITED.

---

St. Catharines, Can., April 23, 1907.

The Canadian Steam Boiler Equipment Co., Limited,
Toronto.

Gentlemen,—We have only had them in two months, so cannot give you a very good comparison yet as to the actual saving, but there is no question about there being quite a saving in the fuel with these grates over the ordinary bars. With proper handling these grate bars should last for years.

Yours truly,
McKINNON DASH & METAL WORKS CN.,
Per Jno. C. Norman, Secy.-Treas.

**All Infringements will be Vigorously Prosecuted.**

# CANADIAN STEAM BOILER EQUIPMENT CO., LIMITED

**36 and 38 Lombard Street, - TORONTO**

## Solid, Genuine British Oak-Tanned

# LEATHER BELTING

—that is what we manufacture, and what you will find the most efficient in driving the wheels of your industry.

# D. K. McLAREN, LIMITED

MONTREAL
309-311 Craig Street West

TORONTO
200 King Street West

QUEBEC
21 St. Peter Street

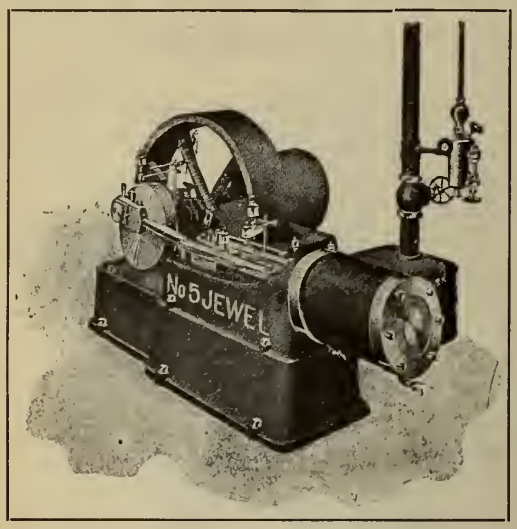
ST. JOHN, N.B.
64 Prince William Street

WINNIPEG
Fred. J. C. Cox & Co., Representatives

VANCOUVER
418 Abbott Street

**Full stock of our "Extra C" Leather Belting and "D.K." Balata at above addresses.**

# Steam Equipment




## Automatic Engines

1 13" & 23" x 30" compound Wheelock
1 refitted 14" x 34" R. H. Wheelock
1 refitted 13" x 30" R.H. Corliss
1 refitted 12" x 30" R.H. Corliss
1 refitted 9½" & 14½" x 12" compound
1 refitted 8" & 13" x 18" compound
1 refitted 12" x 10" Westinghouse Junior
1 nearly new 12" x 12" Armington & Sims
1 refitted 10" x 10" Leonard Peerless
1 new 10" x 15" No. 8 Jewel
1 refitted 8" x 24" L. H. Brown
1 rebuilt 7" x 10" Leonard-Ball
1 refitted 6½" x 9" Armington & Sims

## Vertical Engines

1 refitted 16" x 16" slide valve
1 new 7½" x 10" Dutton slide valve
2 new 7½" x 9" Dutton slide valve
1 new 7½" x 8" Dutton slide valve
1 refitted 6" x 8" piston slide valve
1 new 6" x 7½" Dutton slide valve
1 refitted 6" x 8" Doty slide valve
1 new 5" x 7½" Dutton slide valve
1 new 4½" x 5" Dutton slide valve
1 new 4" x 5" Dutton slide valve
2 new 3½" x 5" Dutton slide valve

## Horizontal Engines

1 refitted 16" x 24" L.H. rocking valve
1 refitted 11½" x 14" L.H. slide valve
1 new 12" x 15" C.C slide valve
1 refitted 12" x 12" C.C. slide valve
1 refitted 10½" x 14" C.C. slide valve
1 refitted 10½" x 16" R.H. slide valve
1 new 10" x 15" C.C. slide valve
1 refitted 11" x 11" C.C. rocking valve
1 refitted 9" x 14" R.H. slide valve
1 new 9" x 12" L.H. slide valve
1 refitted 9" x 12" L H. slide valve
1 refitted 8" x 13" R H. slide valve
1 refitted 8" x 12" R H. rocking valve
1 refitted 7" x 11" R.H. slide valve
1 nearly new 7" x 10" C.C. slide valve
1 refitted 7⅞" x 12" R.H. slide valve
1 refitted 7" x 12" C.C. slide valve
1 new 6" x 9" C.C. slide valve
1 refitted 6½" x 10" L.H. slide valve
1 refitted 6" x 10" R.H. slide valve
1 refitted 6" x 7½" C.C. slide valve
1 refitted 6" x 6" C.C. slide valve
1 refitted 5¼" x 6½" C.C. slide valve
1 refitted 4" x 5" C.C. slide valve
1 refitted 2½ x 3" C.C. slide valve

A copy of our supply catalogue or machinery stock list for the asking

# H. W. PETRIE, Limited

TORONTO MONTREAL VANCOUVER

HIGHEST GRADE

# STEAM SPECIALTIES

JUST LOOK AT THIS LIST

It is not what you pay for an article BUT what the article pays YOU in return for its cost that determines its value to you.

ASHTON — Pop Valves, Relief Valves, Gauges, etc.

MASON — Reducing Valves, Pump Regulators, Damper Regulators, Pressure and other Regulators

We gladly furnish catalogues and full information. Send us your problems in regulation and in the handling of condensation. We are backed by expert experience.

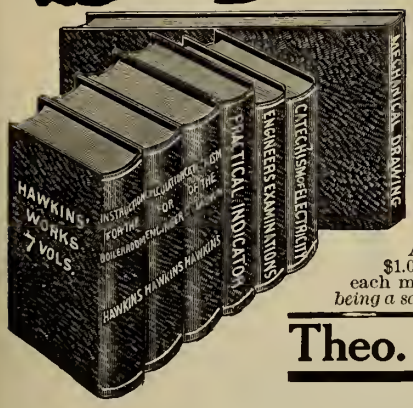
BERRY — Boiler Feed and Damper Control
BAT — Water and Electrical Meters
POWERS — Automatic Temperature Regulation
BUNDY — Steam Traps for all Services
OSBORN'S — Famous "Hand & Heart" Mining Steels

We sell ONLY the BEST and GUARANTEE RESULTS

**PEILLER & MacKENZIE, 17 St. John St., Montreal**

*Hawkins Works*

# On Easy Payments.




Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

**SPECIAL OFFER** Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month (*when complete set is purchased the price is $12, being a saving of One Dollar*). **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed ..... (Firm Name)

Home Address .....

**Every Manufacturer Using a Steam Boiler Should Know** that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)

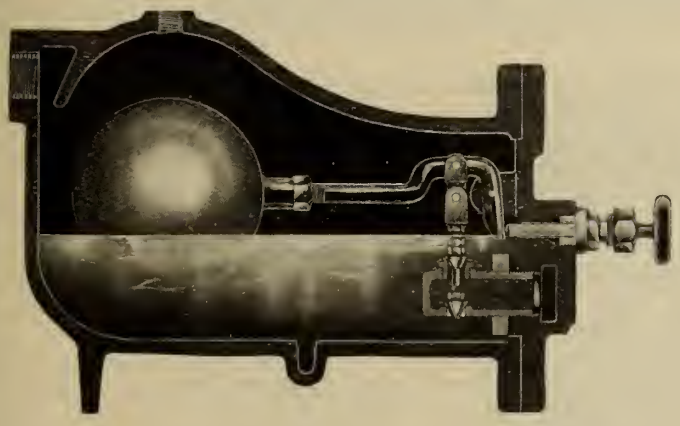
**IS THE**

## GUARANTEED BOILER CLEANER

Manufactured by

**The CANADA CHEMICAL MANUFACTURING COMPANY, Limited**

Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL



## The Modern Steam Trap

# Sheldon Continuous

# Flow Float Trap

**Adapted for High or Low Pressure Work**

Greater capacity than single valve traps.

Discharges continuously as fast as the water enters.

Double cone-shaped balanced valves operated by a high pressure seamless copper float, tested to 300 pounds pressure.

The conical shape of the valves makes it impossible for them to stick or be affected in any way by foreign matter which may enter the trap.

All working parts attached to the trap cover, which can be removed without disturbing the inlet or outlet pipe connections.

By-pass valve in cover so steam can be given a free passage around the valves when desired.

Casing provided with bosses which are tapped for gauge glass and air cock.

Write for Sectional Catalogue No. 56.

Eastern Agents:
**ROSS & GREIG**
225 St. James Street
Montreal, P.Q.

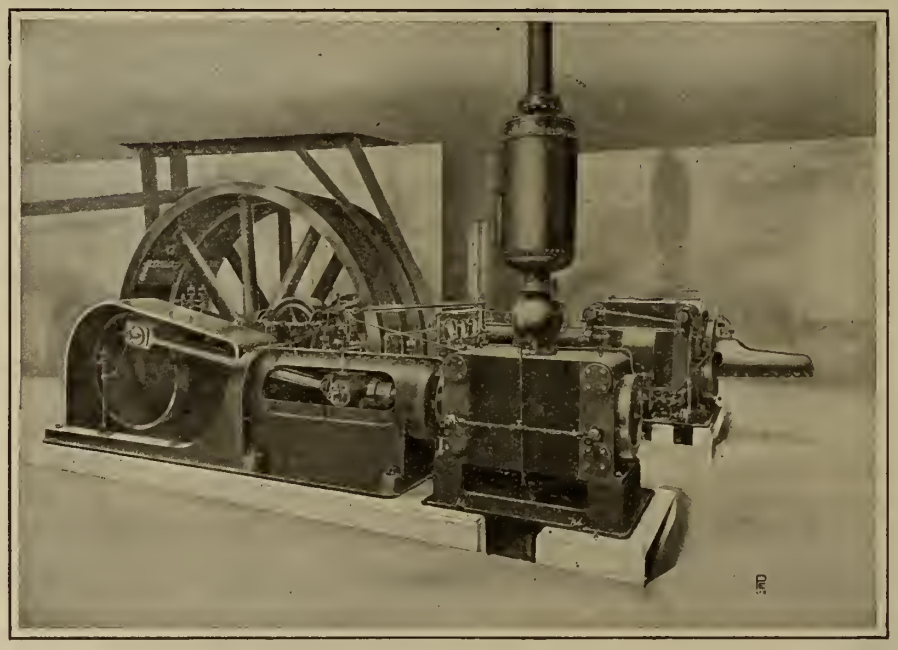
# SHELDONS LIMITED

GALT, ONTARIO, CANADA

Stocked in all sizes for immediate shipment.

## SOME OF THE USERS OF

# GOLDIE CORLISS STEAM ENGINES



Dominion Iron & Steel Co., Sydney, N.S.
Dominion Coal Co., Glace Bay, N.S.
Windsor, Essex & Lake Shore Ry., Kingsville, Ont.
Galt, Preston & Hespeler Elec. Ry., Preston, Ont.
Corporation of Prince Albert, Prince Albert, Sask.
Cosmos Cotton Co., Yarmouth, N.S.
Grand Trunk Railway System, Stratford, Ont.
Alexander Brown Milling Co., Toronto, Ont.
Corporation of Barrie, Barrie, Ont.
Superior Portland Cement Co., Orangeville, Ont.
Corporation of Strathcona, Strathcona, Alta.
Belleville Portland Cement Co., Belleville, Ont.
McGregor-Gourlay Co., Galt, Ont.
Corporation of East Toronto, East Toronto, Ont.
Lang Tanning Co., Berlin, Ont.
Canada Coating Mills Co., Georgetown, Ont.
Beardmore Belting Co., Acton, Ont.
Corporation of Indian Head, Indian Head, N.W.T.
Raymond Milling & Elevator Co., Magrath, Alta.
Galt Malleable Iron Co., Galt, Ont.
Farmers' Milling & Elevator Co., Prince Albert, Sask.
Corporation of Kincardine, Kincardine, Ont.
Lion Brewing Co., Berlin, Ont.
St. Lawrence Starch Co., Limited, Port Credit, Ont.
Ellison Milling & Elevator Co.,Limited, Lethbridge, Alta.
Standard Fitting & Valve Co., Guelph, Ont.
Waterloo Knitting Co., Hawthorne Mills.
Bathurst Lumber Co., Ltd., Bathurst, N.B.
Kaufman Rubber Co., Berlin, Ont.
The T. H. Taylor Co., Chatham, Ont.
Jas. Davidson, Ottawa, Ont.
Central Electric & Gas Co., Portage La Prairie, Man.
Strathroy Furniture Co., Strathroy, Ont.

## The GOLDIE & McCULLOCH CO., Limited

GALT, - ONTARIO, - CANADA.

WESTERN BRANCH:
248 McDermott Ave., WINNIPEG, MAN.

QUEBEC AGENTS:
ROSS & GREIG, MONTREAL, QUE.

B.C. SELLING AGENTS:
ROBT. HAMILTON & CO., VANCOUVER, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Boilers, Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Woodworking Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION.

# A Canadian Instalation of Riche Producer Gas Plant

## A Unique Plant in which Shavings, Sawdust and Refuse are Used as Fuel —Description of the Riche Process of Manufacture of Producer Gas.

The Gendron Manufacturing Co., 137 Duchess St., Toronto, have instaled a Riche Producer, manufactured by Cie Du Daz H. Riche, 8 Rue St. Lazare, Paris. This is the first instalation in Canada, but many other instalations of this make have been made in Europe. An expert from Paris supervised the erection of the plant. Previous to coming here he had been in Ceylon, where they burned cocoanut shells. He also installed Riche Producers in Russia and Roumania, using straw to produce gas. In the Gendron plant shavings, sawdust and refuse from their factory are utilized.

Fig. 1—Riche Producer at the Gendron Mfg. Co.

Fig. 1 is a view of the plant, A being the producer proper, B the purifier, C the scrubber and D the gas receiver. Shavings are carried from the factory in bags and two bags of cuttings and shavings are fed into the producer every fifteen or twenty minutes.

The gases produced in A pass through a square opening in the fire brick into B. This is filled with coke kept in incandescent state. The oxygen supply is not sufficient to burn the coke. The gas passes through B to the scrubber C. Fig. 3 illustrates the producer, but the shavings and refuse are fed from the top instead of the manner indicated in the sectional drawing.

The object of the design shown in Fig. 3 is to insure as far as possible the destruction of the tars and to prevent the clinker from clogging up the column of coke. The chamber B is filled with the raw fuel. The base of this chamber forms the furnace, closed by a door J. and provided with an ash pan D1 and an over-throw pipe C1. At A1 is provided a pipe delivering water to the trays B1, arranged one above the other in the form of steps. E1 is the nozzle for injecting at the base of the column the air required for combustion. At the side of the chamber B is arranged a high vertical shaft E filled with coke through the hopper K. At the top of this column is a pipe I for the evacuation of the gases. Between the chamber B and shaft E is arranged a horizontal passage D, at the point F of which air is injected. This passage D compels the columns of raw fuel and coke to spread at their bases and form inclines closing the ends of the passage or chamber D. The gas producer is started by blowing in an excess of air through the nozzle E, until the column of coke E has become incandescent. Then the air supply through E1 is adjusted for normal working. Water is injected at A if the fuel does not contain a sufficient amount of moisture of its own. In the Gendron plant no water is supplied as the shavings contain sufficient moisture. The gaseous mixture produced at the base of the column in the chamber B reaches the passage D at a high temperature ready for passing through the coke column in the shaft E. The gaseous mixture receives, however, at F additional air, which destroys the greater

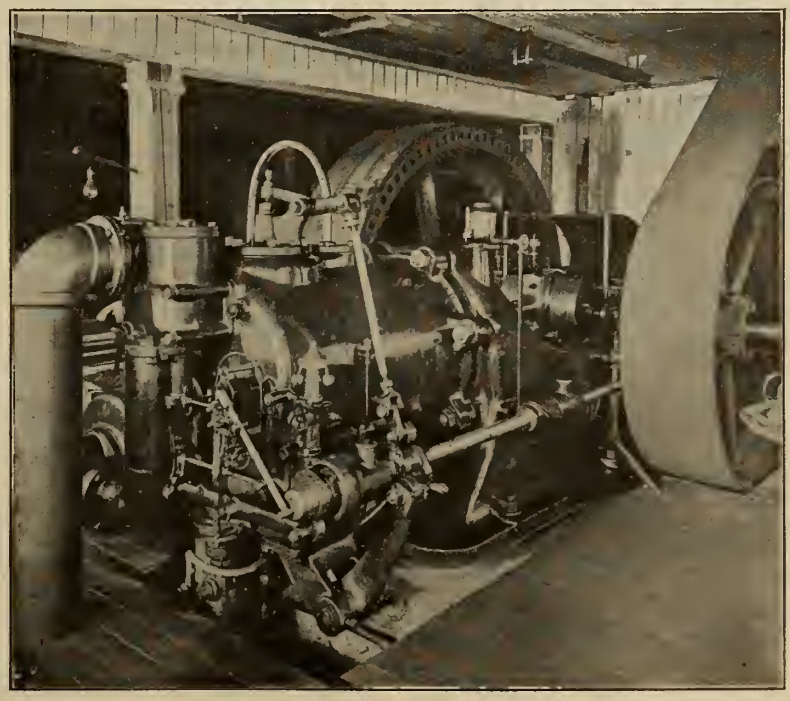


Fig. 2—125 h.p. Tangye Gas Engine.

part of the tars by partial combustion and dissociation. The velocity of the gases in the passage D is reduced on account of its large cross section, so that dust is deposited therein. As the tars are burned in the horizontal passage D before they reach the purifying column of coke, the latter is never contaminated by either dust or clinker. Its purpose is to transform steam and carbonic acid into combustible gases, which the unburnt, or portion of the tar not dissociated, is transformed into permanent gases. The carbon resulting from the dissociation helps to maintain the purifying column. This producer has given no trouble from acetic acid.

The scrubber C, Fig. 1, is made in sections, an iron plate being between each section. The water is sprayed down from a valve in the top and drips from pan to pan, purifying the gas. The drip

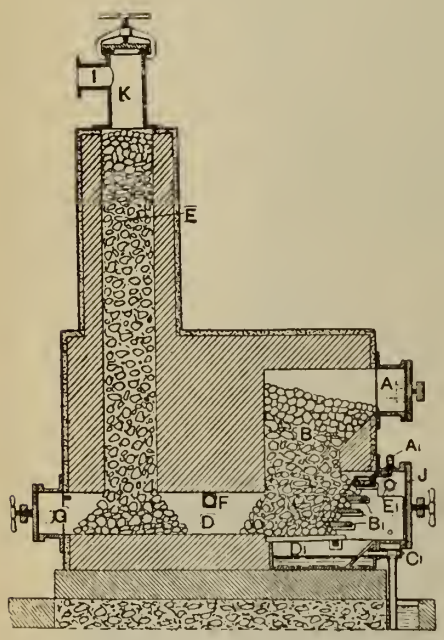



Fig. 3—Section of Riche Producers.

water runs into the waste pipe. The gas flows from the scrubber into the receiving tank D. This tank is self-regulating. When a large supply of gas is generated and the receiver rises to the top of the frame it shuts off the supply of air from the generator, thus lessening the production of gas.

There are two sets of producers, but at present only one is running. The capacity of each one is sufficient to supply gas to 125 h.p. Tangye gas engine, which is instaled in the brick building shown to the right in the photograph. Another engine of the same capacity has been ordered and will be installed immediately. The gas in passing from the receiver to the engine passes through two cleansers filled with excelsior. A 12-inch main connects the gas tank and the cleanser. The first cleanser is located under the platform in the foreground of Fig. 1. The second is located in the engine room. An 8-inch pipe admits gas to the engine and a 10-inch is used for exhaust.

It is the intention to build a house over the producers. In the factory they have a fan system for collecting the sawdust and shavings and a "shoot" will be connected to a vault beside the producers, and the shavings will be blown over direct. Three pounds of shavings are used per h.p. hour. With birch and elm shavings there is very little tar. By buying shavings at 18 cents per hundred pound bale the power costs $7.50 per annum per h.p. for 10 hours' operation each day. The cost per day is less than $3 per 100 h.p., 10-hour day.

The magazine in A, Fig. 1, goes down to the fire, and in this is different from line cut, Fig. 3. The grates are very narrow, but keep the shavings from the door. Over 700 fire bricks are used in each of these producers. The draft enters just above the front door, and a lever on the side of receiver stops the blower. There is sufficient moisture in the shavings so that no hydrogen in the shape of water or steam has to be added.

A water tank will be built around the exhaust of the Tangye engines and steam generated for use in the wood bending department. Gas will also be used under the boilers, which will still be necessary for heating purposes.

Fig. 2 shows the gas engine which is bolted to a concrete base 10 ft. by 12 ft. by 8 ft. deep. The engine is governed by "a hit and miss" governor. The water used in filling the cylinder is pumped back to the pressure tank.

The second engine will be installed at the left of the present engine. A small gas engine will also be installed, and belted to a generator to supply lights in the factory.

## ADVICE TO YOUNG MEN.

By J. M. Mackie.

While this is unquestionably an age of large corporations, I firmly believe it would be better for the future prosperity of Canada if more encouragement were given to the young men of this country to start manufacturing some one special machine in a small way. The press is continually heralding the advent of big enterprises, and our young men are inclined to forget that the great majority of our large enterprises had very small beginnings.

The manufacturing of power house equipment in Canada during the past ten or fifteen years has been very discouraging to the Canadian manufacturer for various reasons, some of the causes have been beyond the control of the manufacturer, but other causes of unsatisfactory results have been overlooked in the burning desire to be big and great.

The method adopted to achieve greatness in the iron trade in Canada has been by manufacturing a large line of various machines, instead of specializing and concentrating all energy in the development of some particular line.

I think I am safe in claiming that no branch of manufacturing has gone through such a complete revolution in the past twenty years, and is now specialized to such an extent as the manufacturing of machinery.

Twenty years ago the purchaser of an engine would visit a machine shop and tell the proprietor the kind of engine he wanted and every detail would be made on the premises, even the bolts and nuts were forged by hand and finished in the shop. To-day an engine is often shipped the day it is ordered, and the average manufacturer only builds one type of engine, which is of his standard design and will not be changed to suit the whims of every purchaser.

The evolution in methods of manufacturing machinery has been perhaps as complete in Canada as in other countries, but the mistake being made to-day by most Canadian manufacturers is in attempting too much.

In the old days a manufacturer prided himself in being able to build any kind of a machine, and our machine shops have not felt disposed to drop the manufacture of any of their various lines, but have tried to specialize them all. Perhaps our northern climate has made us over ambitious, the result is that we have not specialized any one particular line to the greatest possible extent, and our neighbors across the line were able to ship into Canada last year several million dollars' worth of machines which could have been manufactured in Canada. Our imports of machinery will continue to grow until we specialize more thoroughly.

Let no young man shrink from commencing to manufacture in Canada in a small way any machine which he knows to be equal to the best, and for which there is a good demand, because by persevering in one line, special knowledge will be acquired and will bring special results, and the small industries of to-day will become large enterprises in the future of Canada.

---

A peculiar phenomena in connection with a wireless telegraphy station is the formation of light fogs, which seems to be accounted for by the fact that the ether motions produced by the sending station are utilized in electrifying the air, causing condensation of the invisible particles of water vapor into larger drops.

# Test of Engines Manufactured by Robb Engineering Co.

## A Comparative Test of Slide Valve Tandem Compound and Simple Corliss Valve Robb-Armstrong Engines, Made at Amherst, Nova Scotia.

The plant where the data was obtained gives light and power to the Town of Amherst, Nova Scotia, Canada. The power-house contains two tandem compound engines and a simple Corliss engine, each driving by belt two direct current generators. These engines

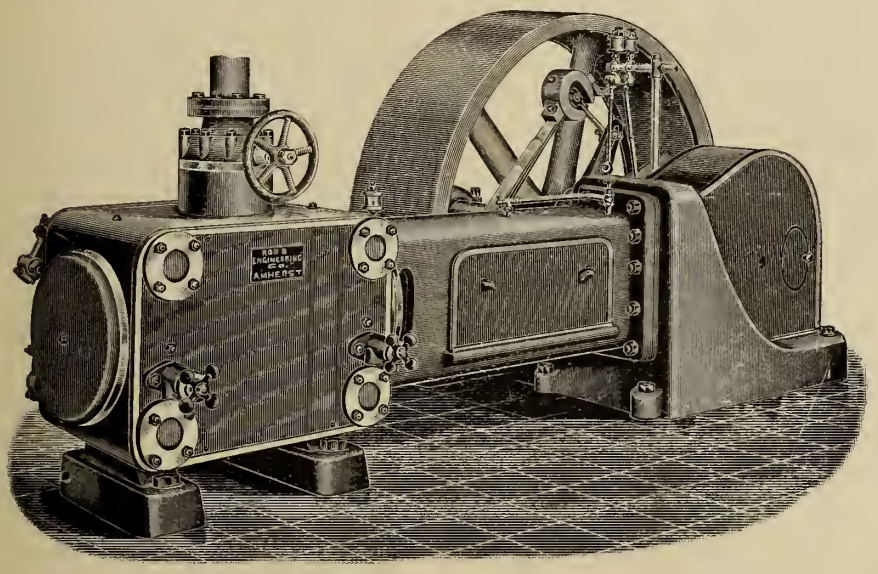


Fig. 1.—Robb-Armstrong Corliss Engine, Type F.

are non-condensing and exhaust through one feed water heater. The small tandem engine was excluded from the test by exhausting it directly to the atmosphere.

For brevity the unit composed of the slide valve engine and generators is called "S" and that of the Corliss valve engine "C". The size and rating of engines "S" and "C" are as follows:

Engine "S"—Bore, 14" and 22"; stroke, 20"; r.p.m., 170; rated horse-power, 220; boiler pressure, 120.

Engine "C"—Bore, 15"; stroke, 24"; r.p.m., 165; rated horse-power, 225; boiler pressure, 120.

The steam valves of engine "S" are of the Sweet or straight line type, balanced against the steam pressure by a heavy stationary pressure plate held away from the valve seat by distance strips, allowing the valve to move freely between the seat and the pressure plate.

The automatic cut-off is obtained by means of the "Robb-Armstrong-Sweet" shaft governor, located in the driving wheel of the engine, so arranged that the cut-off of the valves is controlled directly by the action of the governor.

Engine "C" is fitted with the Armstrong-Corliss valve gear, constructed as follows:

The steam valves are caused to open and close quickly and remain stationary during the remainder of the stroke by the introduction of two small links between the wrist plate and each of the bell cranks, the action being almost precisely the same as with the releasing gine. The steam valves are driven positively by shaft gear which controls the cut-off in a similar manner to all shaft-governed engines; the time of admission of steam is varied slightly so that the lead is negative, and the admission line lowered for light loads and early cut-off, which probably gives higher economy of steam consumption. The exhaust valves are driven by fixed eccentrics and wrist plate geared in the ordinary way.

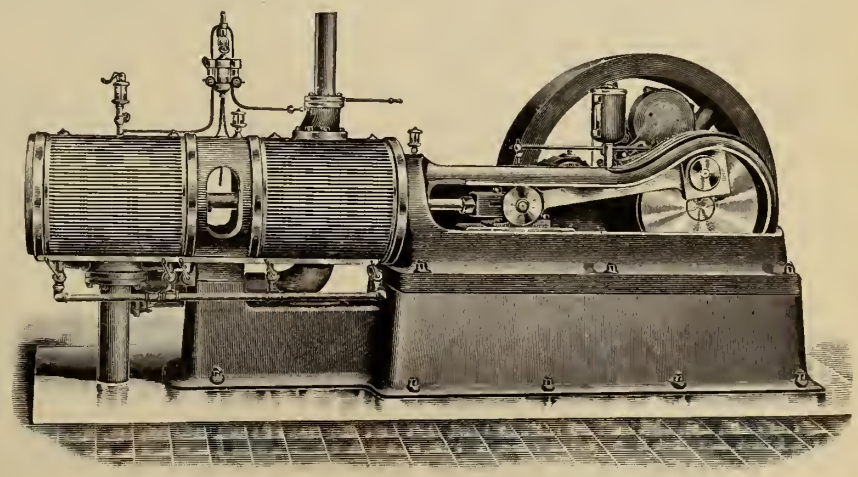


Fig. 2.—Robb-Armstrong Slide Valve Tandem Compound Engine, Type D.

The size and rating of generators of units "S" and "C" are as follows:

Generators "S"—No load, volts, 115; full load, volts, 125; full load, amperes, 440; r.p.m., 925.

Generators "C"—No load, volts, 115; full load, volts, 125; full load, amperes, 600; r.p.m., 850.

The generators are connected in series and deliver current on the three-wire system.

The electrical power was absorbed by a water rheostat improvised for the occasion; it consisted of the end of an old boiler drum, three feet in diameter and five feet high. The neutral wire was connected to the shell of the drum, while the outside terminals were connected each to a sheet of boiler plate arranged so as to slide vertically in wooden guides. Each plate was tapered to a point at the lower edge, so it was possible to draw just the current required for the various loads.

The rheostat was placed out of doors and the severe cold weather aided in keeping the water from evaporating too rapidly.

The condensers used in this test consisted of feed water heaters. Each heater is composed of a vertical cast iron shell. The exhaust steam enters one side near the bottom, passes up to the top, over a baffle plate, down and out the other side. In passing it surrounds

a number of brass tubes containing in the ordinary use, feed water, but in our case the water ran through and to waste. We used two five hundred horse-power heaters in conjunction with the

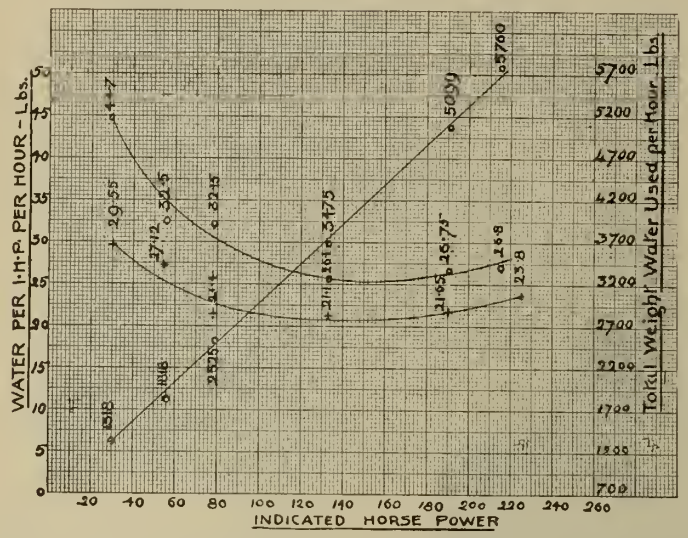



Fig. 3—Result of Test of 15-inx24-in. S.C. Corliss Type F o Curve Plotted From Water Condensed Per Hour at Exhaust + Curve Plotted From Water Per 1 H.P. Per H our From Ind. Curves.

old heater, and piped them up in such a way that the condensed steam could be drained to tube placed on scales, and weighed. The final exhaust outlet of this line of condensers was left open so the engines would be exhausting at atmospheric pressure.

The switchboard instruments were then calibrated by comparing them with standard instruments. The indicators were cleaned, tested, oiled, and lined up. The pressure plates and valves scraped true, also pistons examined, and the tandem was ready for the test.

Loads were carried on the engine, commencing with full load, then three-quarters, one-half, one-quarter and zero, as near as they could be approximated from the electrical readings. It was found impossible to carry an overload on the engine as the generators were too light, and the indicators would also run off the scale of the switchboard instruments. Each load was carried for one hour, indicator cards and readings being taken every ten minutes. The total weight of water for each load was recorded.

In the test of the Corliss engine the same general mode of procedure was followed. The results of these tests are shown in tabulated form on line cuts. These show a comparison of the efficiencies, steam consumption and general economical workings of the two engines.

A comparison of the two tables shows better results for the Corliss engine. The steam consumption per hour per horse-power for engine "S" runs from 60 lbs. at zero load to 27.85 lbs. at full load, this evidently being the load for highest economy. The table of steam consumption of engine "C" shows a decrease from 44.7 lbs. per hour per horse-power for zero load to 26.1 lbs. per hour per horse-power for three-quarters load, and then a slight increase to 26.8 for quarter overload.

The efficiency of the Corliss engine in per cent varies from 85.97 at full load to 83.72 at quarter overload and 54.6 at quarter load. The slide valve efficiencies run from 78.6 at full load to 18.9 at one-quarter load.

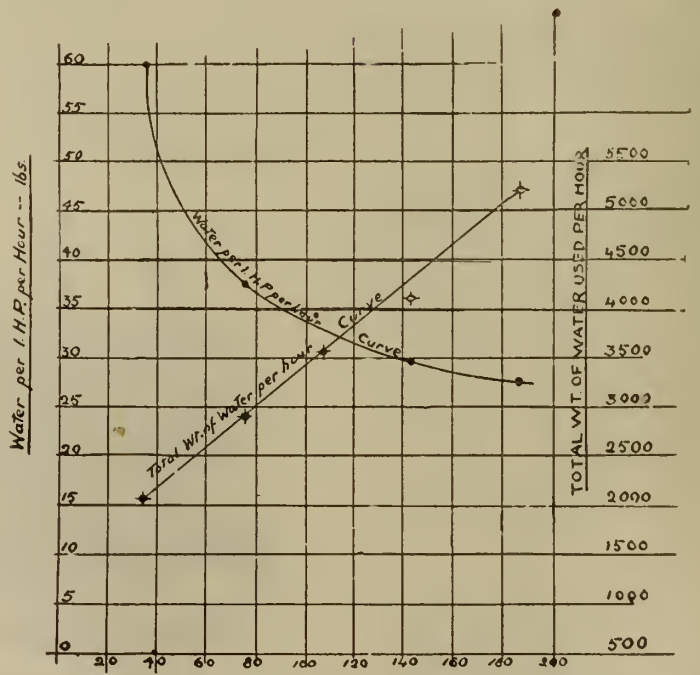



Fig. 4—Result of Test on 14-in. and 22-inx20-in. S. C. Tandem Single Valve Engine.

This test was made by the senior class at the Stevens' Institute of Technology, Hoboken, N.J.

## PERSONAL.

E. I. Sifton has been appointed Engineer of London, Ont. Mr. Sifton will commence his duties at once.

Charles T. Main, mill engineer and architect, has been appointed by the council of the American Society of Mechanical Engineers as a member of the National Conservation Commission, with special reference to water powers. Mr. Main is particularly well equipped for this work through wide experience in examinations and reports upon various water powers in this country and in Mexico and British Columbia.

Mr. C. H. Mitchell has now associated with him in partnership, his brother, Mr. Percival H. Mitchell, and together they will carry on practice as consulting and supervising engineers with offices as before in the Traders Bank Building, Toronto. Mr. Charles Mitchell's name is well known throughout the Dominion in connection with hydro-electric power engineering as well as with general, civil and municipal works. Mr. P. H. Mitchell, who is a graduate of Toronto University, 1903, was for some years employed in the works of the Ontario Power Company at Niagara Falls, and on the Winnipeg Municipal power plant, as well as on several steam and electric plants. These gentlemen will attend specially to hydraulic and steam-driven electric power undertakings, industrial engineering and electrification of factories, electric railways, and municipal projects, including sewerage, waterworks, bridges and electric lighting.

# Adoption of Gas Plants in Quebec as a Source of Power

## The Province of Quebec is Far in Advance of the Others in the Adoption of Suction Gas Plants—Description of Several Instalations.

By J. DE CLERCY, C.E.

The first instalations of suction gas plants were made in the Province of Quebec over five years ago. At that time, Messrs. Dufresne et Locke, shoe manufacturers, at Maisonneuve, installed a Dominion Producer, rated at 18 h.p., and a Crossley gas engine in connection with the producer.

After using this apparatus for two years and making sure that the consumption of coal never exceeded 190 lbs. per day, including everything, these same manufacturers installed another producer of the same design as the first, in connection with a 60 h.p. Hornsby-Stockport gas engine.

At the same date Mt. St. Louis College, Montreal, also installed a 22 h.p. Dominion Producer, with a gas engine, to make the power required for lighting the buildings. This plant has run without a stop, every day since its instalation, except during the holiday seasons. The instalation of a larger plant is now contemplated, on account of the enlargement of the institution.

After these first successful instalations many others of the same kind were installed in Montreal, City of Quebec and in a number of smaller towns in the Province. Among others, may be mentioned the one instaled on Sir Geo. Drummond's farm at Beaconsfield, that of the Christian Brothers' printing shop, Montreal, Town of St. Louis, and Royal Paper Box Co., Quebec, in all over thirty instalations or more of various producers designed to make gas from a variety of fuels.

### Power for Small Printing Shop.

In this case steam had first been used and, in spite of the advantages of free heating in winter, it had to be given up, because it was found that the excessive expenditure of fuel, the cost of attendance and of maintenance, etc., ate up all the profits of the business. Electric power was then experimented with and 12 h.p. were taken from a company. The cost of running was, then:

| | |
|---|---|
| Motive power (12 h.p.) | $ 780 |
| Maintenance of motor | 25 |
| Cost of lighting | 150 |
| Cost of heating, over and above refuse of shop | 56 |
| Total per annum | $1,011 |

A city gas engine outfit was later substituted for this and a 9 h.p. engine was found sufficient to do all the work required and supply the electric lighting of the place as well. The cost of operation was found to be as follows:

| | |
|---|---|
| Cost of power and lighting | $300 |
| Heating of shops | 56 |
| Maintenance and attendance | 60 |
| Total cost per annum for same work as electric plant | $416 |

The saving realized on this instalation, as compared to the cost of electric current in the previous instance, was $595 per annum, a sum sufficient to pay for the cost of the whole plant in 18 months.

Later on, the owners in this case had to increase their plant requiring more power up to 23 h.p. They decided to instal a Dominion Producer and a Tangye's gas engine. The refuse from this plant, accumulating during the summer, added to the refuse of the factory provided sufficient to heat the shops in winter, without any supplementary coal being necessary. Below will be seen the cost of running this plant. (The attendance consists in the foreman taking care of the plant about one hour every day):

23 h.p. motive power, lighting, etc.

| | |
|---|---|
| Heating of the shops in winter | $180 |
| Maintenance, attendance and oil | 140 |
| Total cost per annum | $320 |

showing a saving of 80 per cent. in favor of the producer power plant.

Reducing the two previous examples to cost for 23 h.p. we find that they compare as follows:

| | Per annum. |
|---|---|
| Electric power, 23 h.p. | $1,614 |
| City's gas power | 937 |
| Producer gas | 320 |

Taking into consideration the cost of writing off interest, etc., on these plants, at the rate of 10 per cent. of the actual cost in capital invested, we get:

| | |
|---|---|
| Electric plant, $500@10% | $ 50 |
| City's gas engine, $1.256@ 10% | 125 |
| Producer plant, $2,150@ 10% | 215 |

which brings the total annual cost of all the three powers to:

| | |
|---|---|
| For electric power | $1,664 |
| For city's gas | 1,062 |
| For producer gas | 535 |

That is a saving of 37 per cent. in favor of city's gas, and 67 per cent. in favor of producer gas power, as compared to the electric power, for small plants such as this.

A simple calculation to compare the actual cost of power per annum will prove that city's gas at $1 per 1,000 cubic feet is equivalent to electric current at about $38 per h.p. per anuum, while the producer gas power could not be equalled in economy except with electric current at $16 per h.p. per annum, delivered right at the machines.

### Power for Shoe Making.

Four years ago, a firm of shoemakers set up two 37 h.p. gas engines with Dominion Producers as a substitute for electric power. The expenditure on the electric power was as follows:

| | |
|---|---|
| Electric current for power and light | $2,575 |
| City gas for various purposes | 175 |
| Heating of works besides factory refuse | 250 |
| Total cost per annum | $3,000 |

Producer gas power:

| | |
|---|---|
| Motive power and gas for glue pots, etc., and for electric lighting of factory, 500 lbs coal a day | $360 |
| Attendance, the attendant doing other work besides | 400 |
| Heating of factory for the winter, provided for by the refuse of plant and factory | ... |
| Maintenance, oils, etc. | 100 |
| Total cost per annum | $860 |

Later on, this factory increased their power to 100 h.p., which, under their old system of electric power, would have cost them some $6,500 a year, whereas the same power is now costing them $1,500.

In four years the plant paid for itself out of the money it saved, and it is just as good as it was four years ago.

These manufacturers claim that, with their old system, they never lost less than 24 hours per annum for breakdowns, and there are no stoppages due to the gas plants.

Moreover, as they now consider the cost of their power as a negligible quantity, they have adopted, for special kinds of work, improved machines, which are handier and quicker in doing their work, without being compelled to consider the amount of power these machines required to run them. In former times, they could not have afforded to use these machines. For instance, they only use at any one time about one-third of the number of electric irons in the factory. With electric power from the

distributing companies the power paid for was for the use of all the irons, the maximum, which would make their use impractical. They now use only what power is actually needed, saving the difference. This is one of the facts which tend to prove the economy to be found in the application of producer gas power.

Another striking advantage is the following: Formerly, if one of the branches of the factory was behind in its work, as compared to the others, the whole factory was delayed by the fault of this one branch. Under the present system, no account is taken of the expense incurred in allowing any fraction of the factory to run on a light load, for three or four hours, and for three or four days following, if necessary, to correct any partial delay in the process of manufacturing. The loss is not worth considering, whereas it would have been rather costly under former conditions.

A number of other examples similar to the above could be quoted, but these have been selected as having thoroughly established their reliability by a highly successful period of running, of a length sufficient to effectively refute the objections made to this kind of power in Canada. Producer gas power has been objected to from the standpoint of heating the factory. True it is that an independent heating apparatus must be installed but as has been shown this addition does not add materially to the cost of instalation nor that of maintenance. The coal used is low-priced anthracite screenings, helped out by the refuse from the producers. Another objection is that the gas engine and producer plants are unable to furnish any more than their rated nominal horse power. This, however, is entirely a matter of definition; the power of a gas engine is defined by the maximum power it can develop, because that is the only basis upon which an exact definition of the power of these engines can be based. It would, therefore, be manifestly absurd to attempt to get out of such an engine any more than its maximum h.p. defined, as this power happens to be by the latter word. It is the buyer's business and that of the seller to base themselves upon that definition in the selection of an engine capable of giving the power required at all times.

Detractors of gas engine power have attempted to establish the belief that a gas engine expends an enormous quantity of fuel when running under less than full load. But if we consider, for instance, a 100 h.p. producer gas plant running on coal at 5 per cent. ash, we find that the amount of that coal burnt per h.p. per hour is as follows, under various loads:

| | Per h p hr. Lbs. |
|---|---|
| At full, or 4-5 of full load ..... | 0.90 |
| At 70 per cent. of full load ..... | 1.00 |
| At 50 per cent. of full load ..... | 1.10 |
| At 25 per cent. of full load ..... | 1.50 |

which means that, even at its worst, the gas plant shows a saving of over 50 per cent. on the steam plant.

In cities an overload for a little time could be handled by using city gas in the engine during that time.

The reliability of the gas engine seems to be very well demonstrated. At least, to the users above mentioned and others of the same class, who have sent in repeat orders, establishing their satisfaction. Besides suction gas plants using pea anthracite. there are several plants in the Province of Quebec using peat gas, wood and sawdust gas. One of the latter was installed five years ago for Sylvestre Freres, Clairvaux, P.Q.

### Advices About Suction Gas Plants.

The demonstration of the merits of this kind of power plant for Canadian industries has been made. Suction gas plants running on American peas of anthracite are steadily increasing in numbers every month. Some defective instalations have been made, of course, by people who were new to the business. This was unavoidable, in a country where gas engines were so little known.

Some defective plants have been re-erected in other works where they are now giving entire satisfaction. The knowledge acquired by the men who fit them up is an important element of success for such instalations. The best engineer in the world will be unable to get good results out of these plants, if the seller or the man who erects the plant is unable to furnish him with the theoretical and practical information which are the essential requisites for such plants so different from steam plants.

For small powers, any man with an ordinary degree of intelligence and carefulness can do all that is required for the proper attending of these machines, and, moreover, he can be given other work to do, besides, in the neighborhood of the plant, a fact which allows of a low cost of attendance.

The principal points to which the attention of a buyer of one of these plants must be called are the following:

1. Order only such types of producers as have already established their reliability to run on the class of fuels available for the case in hand.

2. Take an engine of power amply large to supply the maximum requirements which the plant may be called upon to produce.

3. Buy anthracite pea coal on samples only, and insist that this anthracite shall not contain over 13 per cent. ash.

4. Sift all this coal on a ⅜-inch mesh sifter.

5. Use a grade of cylinder oil which shall leave no deposits upon the piston.

6. Order a certain number of spare pieces, such as springs, piston rings, etc., so as to be sure never to run out of them.

7. See that both the engine and the producer are kept in state of the greatest cleanliness.

8. Take care to have in your employ two men at least who have been instructed with the running of such plants, and know yourself how to run them.

Manufacturers who follow out this plan of operation will be satisfied with their producer plants.

---

## GOLDIE & McCULLOCH GAS ENGINE.

The Goldie & McCulloch Co., of Galt, has recently acquired the Canadian rights to the gas engine patents of Mr. L. F. Burger, of Beloit, Wis., and has designed a type of engine embodying the essential features of these patents.

As will be seen from the illustration, this is a two-cylinder tandem double-acting engine—a type now generally adopted for high power engines, as it has the advantage of obtaining power from four cylinder ends without any increase in the size of frame, shaft or pins, and at the same time gives two impulses every revolution.

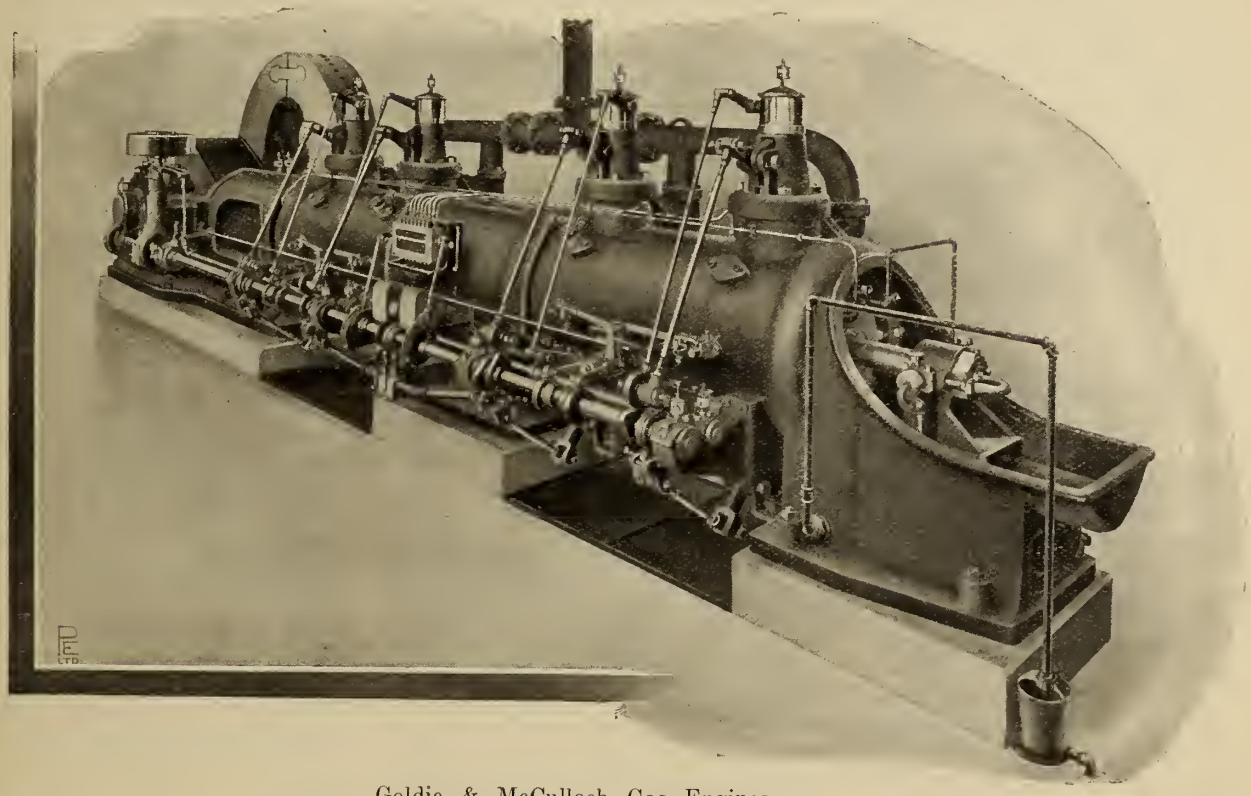
### Valve Gear.

One of the most important features of the engine is the method of admitting the gas and governing the quantity. The governing is done by admitting suitable quantities of a constant mixture. This mixture is admitted through an auxiliary valve whose time of opening is controlled by the governor. The valve is placed directly over the main inlet valve, which opens slightly before the piston reaches the end of its stroke and admits free air to the cylinder producing a scavenging effect. The auxiliary inlet valve is afterwards opened where determined by the governor and closes at the end of the stroke. Variable quantity with constant compression is thereby obtained. The governor used is the celebrated "Rites Inertia Governor," which is adapted to taking care of sudden changes of load with a minimum change in speed. The main inlet and exhaust valves are of the mushroom type, with removable seats in water-cooled cages.

The main valves are operated from a cam shaft fitted with cams engaging with rollers on the ends of the valve rod levers. These cams and rollers are designed to give accurate timing to the

valves and have large wearing surfaces. The auxiliary valves are operated from a supplementary cam shaft running parallel to the main cam shaft and connected to it and the governor through a "floating" gear arrangement.

The pistons and rods are water-cooled and are supported by the main cross-head, and also intermediate and tail cross-heads, thus keeping the weight of the pistons off the bottom of the cylinders and giving the packing and lubrication every chance to be effective. The lubrication of the pistons is effected by a positive feed oil pump, which is so arranged that the drop of oil can be delivered to the interior of the cylinder at exactly the right moment. The piston rod packing is metallic of a design that has proved its worth on some of the largest engines built in America, and is extremely simple, and, if properly installed and cared for, should last indefinitely.



Goldie & McCulloch Gas Engines.

### Cylinders and Frame.

The cylinders are water jacketed, the jacket being provided with a large number of handholes which give easy access for cleaning out should the circulating water be of such a nature as to leave a deposit.

The frame connecting piece between the cylinders and the tail cross-head support are heavy castings with the metal properly distributed to carry the strains. The peculiar design of the cylinder connecting casting with its large opening and removable strut gives a convenient access to the intermediate cross-head and cylinder covers. The frame is provided with a cross-head of large diameter which enables the front cylinder cover and piston to be removed without disturbing the crank shaft. The crank shaft is supported by a main bearing on each side of the crank pin, thus distributing the strains evenly about the centre line of the engine and providing enough bearing surface to keep the unit pressure within safe limits for continuous service. The main bearings are provided with wedge adjustment.

The crank shaft is made from a solid steel forging and is liberal in its dimensions and besides the two main bearings is provided with a large adjustable self-oiling outer bearing on the fly-wheel side. The crank carries counter-weights of sufficient weight to properly balance the engine.

The starting device is extremely simple and automatically admits compressed air to the two inner cylinder ends so that these can be used to start the engine. When well started gas can be admitted to the two outer ends and got under working condition when the air can be shut off and the other two ends started firing.

The igniter mechanism is of the make and break type, and the timing of the spark is adjustable by hand when the engine is running. The engine is provided with two magnetos for supplying the current when the engine is up to speed and a double set of batteries and spark coils for starting.

The water circulation is arranged so that each part can be given just the amount of water required. Discharge funnels are provided on all outlets so that the operator can feel the temperature of the discharge water.

The engines are designed to run on natural, illuminating or producer gas.

The Goldie & McCulloch Co., Limited, are manufacturing producers to furnish with their gas engines which are to run on producer gas. These producers are built under Burger patents.

The generator is not provided with any grates, but the fire is built upon a bed of ashes which rests on the foundation. The ashes can be removed at any time through the water seal without opening up the generator and this feature makes it possible to run the producer continuously without any interruption whatever.

The vaporizer is in the shape of a shallow pan placed directly over the fire at the top of the generator, and steam is admitted by a down pipe through a central tuyere casting with umbrella top. The sides of the generator lining are vertical, which allows the fire to be easily poked and eliminates any danger of "bridging."

The vent valve is so arranged that when the engine is running the opening to the stack is water sealed. The scrubber is of the "wet" type and a sufficient expansion tank is provided to keep the draft approximately constant.

## ALBERTA'S LICENSE LAW.

The following is a memorandum of information for the guidance of persons desiring to qualify as engineers under the provisions of the Steam Boilers Act.

Under the provisions of the Steam Boilers Act it is illegal for any person who does not hold a certificate of qualification to be in charge of or to operate a steam boiler or engine connected therewith, and persons acting in contravention of the act are liable to a penalty of from $5 to $50. The act provides for obtaining a certificate of qualification as engineer in three ways:

1st. Any person who holds a certificate of qualification as an engineer from any incorporated body authorized to grant such certificates of qualification for operating steam boilers and engines or from the Dominion or any Provincial Government or from any competent authority in any other portion of the British Empire or the United States of America shall be entitled, upon making application to the Minister accompanied by such evidence of his qualification as may be required by the Minister and upon payment of a fee of $5, to obtain a certificate of qualification as an engineer in the class determined by the Minister.

2nd. Those who have had over one year's experience in charge of and operating steam boilers and engines outside of this Province, upon furnishing evidence of the fact and passing an oral examination before an inspector, can obtain Provisional Certificates, which entitle them to act as engineers to operate steam boilers and engines of any capacity not exceeding 35 horse-power for one year, and at the expiration of such certificates, if the holders desire to continue to act as engineers, they have to undergo a written examination for 1st, 2nd or 3rd Class Certificates, as may be determined by the inspector. The fee for a provisional or final certificate is $5.

3rd. Persons who have had no experience in operating steam boilers and engines, but who desire to become engineers, can do so by serving as apprentices for one year to an engineer or engineers who are registered as holders of 1st, 2nd or 3rd Class Certificates for the Province, and at the expiration of such time passing an examination before an inspector.

Examinations for final certificates are held from time to time at various points throughout the Province by the inspectors, and persons desiring to undergo an examination should notify the inspectors or the undersigned so that they may be informed of the next date of examination.

The names and addresses of the inspectors are:—Joseph Buxton, Calgary; David Fraser, Strathcona; F. W. Hobson, Red Deer.

Persons undergoing a written examination are examined as to their knowledge of the construction, care and operation of steam boilers and engines, also a certain list of theoretical and practical questions. Any candidate through lack of education may be allowed to secure the services of a person who will write answers to questions, or interpret only as instructed by the candidate, but such person or interpreter shall not be an engineer.

Candidates writing for a 1st Class Certificate must obtain 70 per cent. of the total number of marks allotted; those writing for 2nd must obtain 60 per cent., and for a 3rd, 50 per cent., in order to pass. Those who fail for 1st but make 60 per cent. of marks allotted may be granted a 2nd Class Certificate, and those making only 50 per cent. on 2nd may be granted a 3rd Class Certificate.

Candidates failing to pass may not again write for the same or a higher class of certificate until after the expiration of one year.

For the guidance of those who may desire to present themselves for examination for certificates as engineers, the following information is given regarding the subjects of examination.

The questions are, as has already been stated, of both theoretical and practical character and may be divided as follows:

(a) Questions relating to the origin of steam and its uses.

(b) Questions relating to the different kinds and manner of constructing boilers to generate steam, including the strength of materials used in making boilers, and the proper proportion in sizes and thickness of material to be used, together with proper areas of grate, etc.

(c) Questions regarding the different kinds of safety valves for controlling the pressure in steam boilers and other necessary fittings.

(d) Questions regarding the proper methods of raising and maintaining steam in boilers and the care necessary to keep them in good order, and when repairs are necessary the method of making such repairs.

(e) Questions regarding the kind, construction and operation of the different appliances used to feed and supply boilers with water during operation.

(f) Questions regarding the different kinds of engines used in developing steam, including their construction and the methods of calculating their power and the proper methods of caring for and operating such engines.

The questions are made as clear and concise as possible and every effort has been made to make the questions cover such theoretical and practical knowledge as should be possessed by every engineer charged with the care and operation of steam boilers and engines.

Candidates desiring to qualify for examination can obtain the necessary theoretical information to enable them to answer the questions by studying any recognized text book on the boiler and steam engine, such as Thurston's complete text books; "Practical Points," by John Farnum; "Henry C. Tulley's Handbook on Engineering."

Forms of application and any additional information may be obtained by addressing the undersigned. John Stocks, Deputy Minister, Edmonton.

---

## DEPRECIATION IN STEAM PLANT.

It is impossible to establish a hard and fast basis for depreciation of a power plant, but Mr. Charles T. Main, Mill Engineer, of Boston, very concisely presents the average conditions as follows:

"With good water and good care, running about twelve hours a day, the life of a boiler should be about twenty years, or the depreciation five per cent. a year. Slow-speed engines, running ten hours a day, can be estimated as having a life of about twenty-five years, or a depreciation of four per cent. a year. High speed engines are much shorter lived, and will not average over fifteen years, or a depreciation of about seven per cent. a year; and often times it is greater when run ten hours a day. The depreciation when run twenty to twenty-four hours a day is correspondingly greater. Boiler settings and piping should be included with the boilers, and engine foundations and piping with the engines.

"The life of economisers varies with the initial temperature of the entering water from about ten years up to forty."

---

## HE HAD A KICK COMING.

"You made a mistake in your paper," said an indignant man, entering the editorial sanctum of a daily journal. "I was one of the competitors at an athletic entertainment last night, and you referred to me as 'the well-known lightweight champion.'" "Well, are you not?" inquired the sporting editor. "No, I'm nothing of the kind!" was the angry response; "and it's confoundedly awkward, because I'm a coal dealer."—London Telegraph.

---

On turning the current off an arc lamp, if the lower carbon stays red the longer the lamp is burning upside down and the wires should be reversed.

# Course of Lessons for the Instruction of Stationary Engineers

## Second of a Series of Lessons—These Articles Take up in a Simple Manner Steam, Gas and Electrical Engineering, and are Both Interesting and Instructive—This One Deals with Combustion or Burning.

By W. A. CROCKETT

Combustion or burning is chemical combination in which sufficient heat is evolved to make the uniting bodies glow. In ordinary combustion the oxygen of the air is the supporter of the combustion, and during the process it unites with the combustible substance, which is usually carbon, hydrogen or both combined to form compounds of these elements. It must always be remembered that as the action is a mutual one, the supporter of combustion may under changed circumstances become the combustible and the usual combustible may become the supporter of combustion. Thus in a gas jet the coal gas is the combustible and the air or rather the oxygen of it, the supporter of combustion. It is an easy matter to invert the process and make the air burn in coal gas, the products of the combustion being the same in each case.

The most economic value of any fuel as a heating factor is measured by the elements, carbon and hydrogen. Besides these elements there are usually present oxygen, nitrogen and sulphur in small quantities, besides matter which is incombustible.

The elements which either exist as or by the application of heat are distilled into numerous compounds known as hydro-carbons, such as olefiant gas, naptha, tar, pitch, etc., which must pass into a gaseous state before being burned. The result of combustion is the formation of carbonic acid gas, water, nitrogen and some sulphurous acid.

If mixed with a large quantity of hot air, as the inflammable gases are liberated from burning carbons, they are completely burned, producing carbonic acid and steam. When mixed with cold air, they are apt to be chilled and pass off unburned.

If the disengaged carbon is cooled below the temperature of ignition before coming in contact with oxygen, it constitutes when floating in the gas, smoke, and when deposited on solid bodies, soot. But if the disengaged carbon is maintained at the temperature of ignition and supplied with oxygen sufficient for its combustion it burns while floating. The flame from fuel is greater, the more slowly its combustion is effected. The flame itself is apt to be chilled by radiation, as in the heating surface of a steam boiler, so that combustion is not perfect and part of the gas and smoke passes off unburned.

Carbon and exoygen, or hydrogen and oxygen, do not combine at ordinary temperatures. Their temperatures must be first raised to a fixed temperature before the attraction between the two is sufficient to cause them to combine; this is called the temperature of ignition. Since air is 23 per cent. oxygen, therefore complete combustion needs $\frac{100}{23}=4.35$ times the weight of oxygen required, i.e., as 1 lb. of hydrogen needs 8 lbs. of oxygen for complete combustion, therefore it needs $8\times4.35=34.8$ lbs. of air for the same purpose.

1 lb. hydrogen+8 lbs. of oxygen =9 lbs. steam, or water.

Air is composed of 23 parts (by weight) of oxygen, and 77 parts of nitrogen.

On account of the difficulty of a perfect mixture of air with a thick bed of burning fuel, complete combustion is hard to get, and that is why furnaces with ordinary chimney draft require double and with forced draft 1½ times the theoretical amount of air.

The higher the chimney or column of heated air, or the greater the difference between the temperature inside the stock and outside, the greater will be the difference in pressure, and, consequently, the greater will be the velocity upward. This is known as draft.

The control of the draft is by dampers. They diminish the volume of air, but do not affect the pressure at a given temperature.

The intensity of the draft is also largely dependent upon the intensity of the fire, and is, of course, least when the fire is low, which is usually the time when the strongest draft is needed most.

Now that the Railway Commission has made an anti-smoke order, applying to cities in Ontario which have passed by-laws for the restriction of the smoke nuisance, manufacturers will become more interested in this subject. To overcome the "smoke nusance" needs judgment from the engineer and fireman.

By the production of a more intimate assimilation of oxygen with the products of combustion a more rapid and perfect combustion takes place thereby preventing smoke.

It is a very rare instance that the combustion amounts to 25 lbs. of coal per square foot of grate surface per hour, when the draft is dependent upon a stack.

It is a common occurence to produce combustion at the rate of 40 to 50 lbs. per square foot of grate surface and as high as 120 lbs. has been accomplished with a fan or blower.

Increased combustion produces a greater steaming capacity with a given amount of heating and grate surface, to say nothing of the greater economy by the more complete combustion of the fuel when burning at the high rate.

The higher the rate of combustion the greater is the efficiency. Smaller grates, thicker fires and fewer boilers can be employed for a given output. For example, if twice as much heat can be produced by other means than can be produced by natural draft, then only half the usual number of boilers need be fired, and if three times the heat then only one-third the number of boilers.

It has been determined by direct experiment that a lb. of carbon burned to carbonic acid gas, gives out 14,500 British thermal units of heat. When burned to carbonic oxide only 4,400 b.t.u. are given out.

One lb. of hydrogen gives out on perfect combustion about 62,032 b.t.u.

### Smoke and Smoke Prevention.

The formation of smoke is a common source of waste. Bituminous coals which are rich in hydro-carbon gases produce the most smoke. Smoke can be avoided by supplying fresh air to the carbon while it is red hot in the flame. Once formed it is hard to burn smoke, and this is where the fireman's skill comes in in preventing its formation.

A strong draft requires a thick fire, a light draft, a thin one. The larger the size of the coal the deeper should be the bed. Hard coal needs a deeper bed than soft coals.

Bituminous coals containing a large proportion of hydro-carbons, are more economically used by the coking system. The coal is allowed to coke on the dead plate near the door, the hydro-carbon gases are driven off and burned at the front of the furnace, and then the hot mass is pushed towards the bridge, and another charge of fresh coal placed as

before. Firing is best done when the combustion in furnace is good, and, consequently, but little dense smoke is given off. Dark spots in the fire, abundance of smoke, unsteady steam pressure, unsteady water line, dirty tubes, coal in ash heap, are all evidences of careless firing.

British Thermal unit (b.t.u.) is the quantity of heat required to raise the temperature of 1 lb. of water 1 deg. F., at or near its maximum density 39.1 F. Thus 7 lbs. of water raised 15 deg. F.= 7×15=105 b.t.u. The Thermal unit= the amount of heat necessary to raise one pound of water 1 deg. C., and is used by British and American scientific writers.

The Calorie=the amount of heat necessary to raise one kilogram of water 1 deg. C. and is used in France and other countries, using the metric system of weights and measures.

Total heat of combustion or calorific power of a fuel is the number of heat units produced by the combustion of 1 lb. of it. Carbon value of fuel is the weight of carbon in pounds having the same calorific value as 1 lb. of the fuel. Carbon value equals calorific power of fuel divided by calorific power of carbon.

Theoretical evaporative power of fuel is stated in pounds of water evaporated from and at 212 deg. F., and is obtained by dividing the calorific power of the fuel by 966. Actual evaporative power of coal in steam boilers From numerous experiments on steam boilers it appears that the actual evaporative power of coal varies from 50 per cent. to 85 per cent. of the theoretical evaporative power. An average of a number of tests gave an actual evaporative power equal to 70 per cent of the theoretical evaporative power of the coal.

## BOILER COMPOUNDS.

A. Eugene Michel.

The majority of scale-forming and corrosive elements in feed water can be prevented from doing harm by the careful use of a scientifically prepared boiler compound. A broad statement, you may say, and you may be prejudiced against compounds, but it is worth while to study their advantages.

You can deal with scale-forming elements in three ways,—1, Treatment of feed water before it enters the boiler; 2, treatment within the boiler; or, 3, scale removal at periodic intervals.

The first two methods apply also to corrosive elements, which must be rendered absolutely harmless as soon as discovered, if the boiler is to be preserved. If scale and corrosion are to be prevented by external feed water treatment, there is required additional apparatus in the form of a purifier, filter, settling-tank, separator, or a combination of these which may or may not accomplish the purpose thoroughly, and completely. In any event there must first be a considerable outlay of money for apparatus, and then in addition to the interest and depreciation charges on this investment there is constant labor expense for keeping the apparatus clean.

If, on the other hand, the feed water impurities are permitted to form scale which gets thick enough to manifest itself in the form of decreased boiler capacity and efficiency, leaky tube-ends or other trouble, an initial expenditure becomes necessary for cleaning apparatus, which in itself is a source of repair expense. There is a fuel loss, often amounting to 25 per cent., when scale is less than one-quarter of an inch thick, the lost time and the expense of labor during the extended shut-downs necessary for cleaning. Nor does this take into consideration the repair expense, when scale causes tube-ends to leak, or heating surfaces to blister. Replacing tubes is also a common expense when scale is very thick and hard.

The use and action of boiler compound is quite a contrast to the drudgery of scale removal. As compound acts entirely within the boiler, no other apparatus save a feeding device is required. This, as a rule, may be obtained free from the manufacturer of the compound.

Waters carrying a large percentage of impurities require a proportionately large percentage of chemicals to render these impurities harmless, while waters of a better composition carrying a small amount of impurities require a lesser amount of chemicals to counteract the scale-forming and corrosive tendencies.

Again, there is variation in the quantity of each impurity in different waters, and the amount of the chemicals in the compound must be varied for each individual case.

There are compounds which contain elements that will dissolve the scale, although their use is not practical. Soda ash, acid salts, free mineral acids, caustics, acid compositions, etc., are sometimes offered, disguised by useless coloring matter to hide their real nature. Caustic soda, or slacked lime, for instance, will control the corrosion and deposit, but the quantities required would be enough to convert all the boiler water into a foamy mass which would prime, ruin every joint and valve in the steam mains, and perhaps knock out the engine cylinder heads if the stop-valve wasn't closed in time.

If unscrupulous manufacturers filled all orders with the same mixture, totally disregarding the individual conditions, it would mean disastrous results. The following shows the difference between the impurities in the following two waters, for the analyses of which the writer is indebted to the Bird-Archer Co., New York compound manufacturers:

| Sample No. 1— | Grains per al. |
|---|---|
| Solids | 22.829 |
| Organic and volatile matter | 1.011 |
| Sodium chloride | 3.415 |
| Sodium carbonate | 11.170 |
| Sodium sulphate | 1.450 |
| Calcium carbonate | 2.452 |
| Magnesium carbonate | 1.516 |
| Iron oxide and alumina | .714 |
| Silica | 1.101 |
| Free carbonic acid | 6.511 |

| Sample No. 2— | Grains per gal. |
|---|---|
| Solids | 39.923 |
| Organic and volatile matter | 6.235 |
| Sodium chloride | 5.259 |
| Sodium Sulphate | 1.101 |
| Calcium carbonate | 2.145 |
| Calcium sulphate | 16.038 |
| Magnesium carbonate | 1.923 |
| Magnesium sulphate | 4.242 |
| Free carbonic acid | 14.141 |

The above two samples are chemically opposite. No. 1 is of an alkaline nature and under the influence of boiler heat and pressure would tend to foam and prime. The scale from this water would be like mud. As the water inside the boiler would be converted into steam, the sodium salts would concentrate in solution in the water, increase the gravity of the solution, and retard free steaming. If this water was treated with a boiler compound containing alkalis, the harmful constituents already present would do still more harm and increase the foaming tendency.

Sample No. 2 tends to form a heavy crystalline scale, so hard, that if struck with a hammer it would chip like porcelain. In addition to chemicals required to neutralize the various calcium and magnesia salts in solution, the compound should, in this case, show an alkali re-action.

Anyone who disregarded the individual conditions of these two samples and used the same compound in both plants would commit an offence which is nothing short of criminal.

It is peculiar that if the two waters were mixed, a heavy precipitate due to the action of the impurities of one upon those of the other would occur and greatly improve both waters. This is just what the compound does, as well as rendering the precipitate non-adhesive. It is clear that the compound should contain the right amount of each of the right constituents to do its work well. It is also evident that this is a matter of individual investigation for each plant, by a competent chemist and then of following his instructions carefully in applying the remedy he offers. That there is nothing to fear from the use of boiler compounds when these conditions are heeded.

# An Automatic Indicator for Use in Street Railway Cars

## A New Device for Indicating the Approach of the Next Stopping Place —Its Use in Advertising Places of Business or Amusement.

Many of our readers, while riding in a street car, have doubtless often been carried past their street by being unable to distinguish the name as the conductor called out the street. This is generally the case when in a strange town. A very simple and effective method of indicating has been perfected and patented by Messrs. J. N. Leighton, Toronto, and N. Wilkinson, Emporia, Kansas. Their apparatus, as demonstrated by a full-sized working model, is simple and effective, indicating automatically without assistance from either motorman or conductor not only the name of the street the car is approaching, but keeps the passenger fully informed as to his whereabouts, showing him at a glance the number of streets to be passed before reaching his destination.

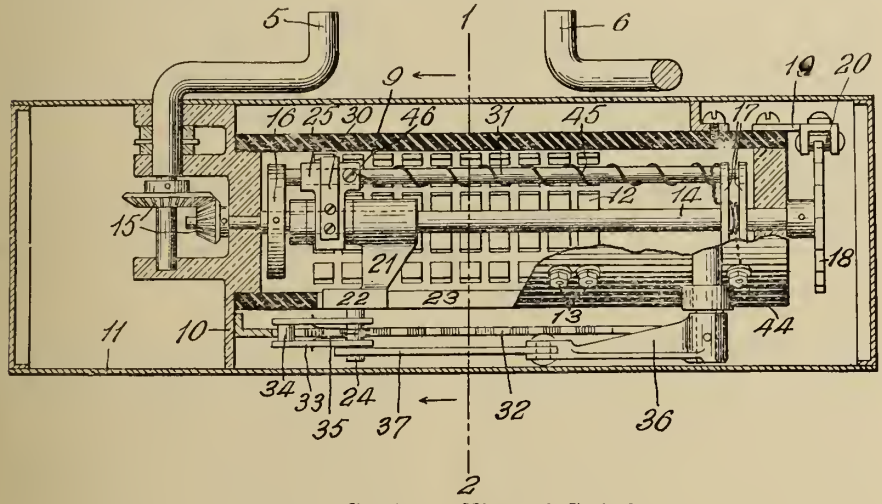



Fig. 1.—Sectional View of Switch.

The automatic operation is simply carried out. Guides are placed on the trolley line at the nearest cross wire to the street just passed. To place the guide on the wire the top of the insulating bell holding the cross wire is removed and the guide dropped on. These guides operate a switch fastened to the trolley pole and by means of a cable of fine wires through the hollow pole communication is made with an indicating board in the car. This board consists of a list of names arranged in consecutive order as the streets occur on the route. These names are printed on celluloid or glass and each in turn is illuminated as the street or place of business which it represents is approached. All cars are wired alike, so that to change a car from one route to another all that is necessary is the insertion of a new set of names. The system is applicable to elevated, underground and third rail, as well as surface systems. It is adaptable to belt line as well as double track lines, and for single track routes a guide with a dog inserted is used to reverse the position of the switch arms. The apparatus consists essentially of a switch attached to the trolley pole near the wheel. This switch has a number of contact plates (depending on number of stopping places on the route) which are connected to a series of lamps so placed as to illuminate the names of the streets or stopping places in proper order on an indicator board which is placed at the front end of a car over the door. The switch has two levers which are acted upon by a series of switch-throwing members attached to the trolley wire at the different stopping places on the route. These are adapted to throw the levers through a certain arc completing a circuit between any particular contact plate and its corresponding lamp. It will thus be seen that the number of contact plates will correspond to the number of stopping places, being arranged to act consecutively. The switch-throwing members are placed adjacent to the street crossings so that when the car has passed any particular street the member will throw the switch, illuminate the corresponding light, thus indicating the name of the next street or stopping place to the passengers. The name of this street will appear so long as the car is between it and the last street, and the next succeeding switch-thrower will, of course, actuate the switch to light the lamp corresponding to the next street.

Fig. 1 shows a longitudinal section through the centre of the switch; Fig. 2 a bottom view; Fig. 3 a section through the switch. This particular switch was designed to accommodate one hundred names and so has one hundred contact plates arranged in ten circumferential rows of ten plates each. When a switch-thrower engages the lever (5) it moves it through an arc of sufficient length to move the contact maker circumferentially onto the next plate. The centre of the next switch-thrower is in a different line and so moves the lever through a further arc and thus the contact maker waves onto the next plate. A glance at Fig. 7 shows how this is accomplished, by virtue of the position of the switch-

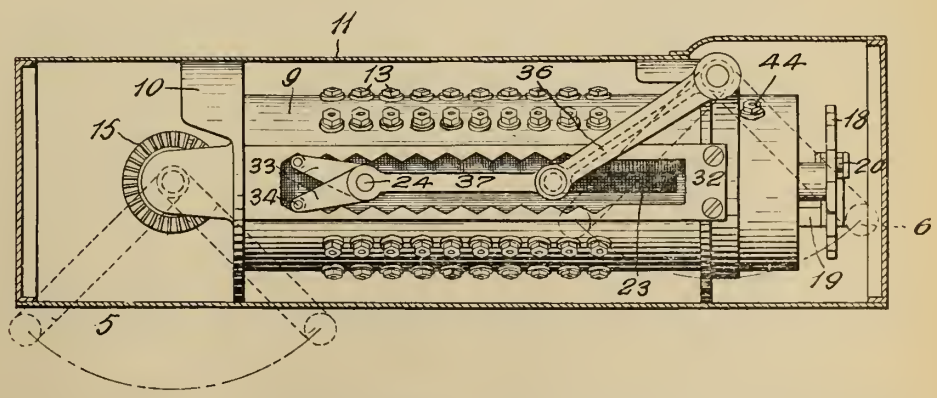



Fig. 2.—Bottom Plan of Switch.

throwers with reference to the centre of the trolley wire. The switch-throwers are stepped at certain distances from the centre of the wire, that is, the distance B (Fig. 5) varies by just enough to move the lever (5) through the required arc each time the lever passes a switch-thrower. The distance

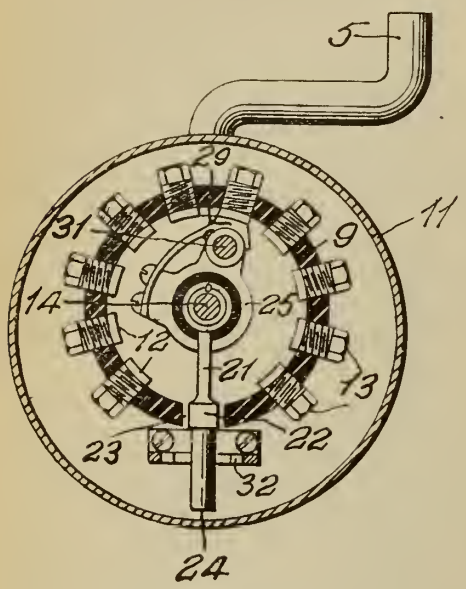



Fig. 3.—Sectional View of Switch on Line 1-2 of Fig. 1.

A remains stationary until the circuit-maker has passed all the contact plates in one circumferential group (10 in this case). Then, on the next switch-thrower the distance A is changed just

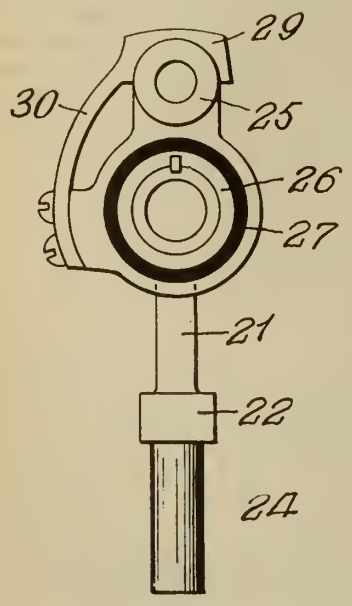



Fig. 4.—End View of Sliding Contact Maker.

enough to move the lever (6) through the arc required in moving the circuit-maker longitudinally on the shaft (14) onto the next circumferential group of contact plates. The circuit-maker now begins to move in the opposite direction circumferentially, on account of the distance B varying in the opposite sense.

It can be readily seen that this apparatus is automatic and will "find itself" if one of the switch-throwers get out of line or broken, because the flare end on the next thrower will engage the lever and thus bring it into its proper position, lighting the proper lamp. If a street was missed the next thrower would move the circuit-maker over two

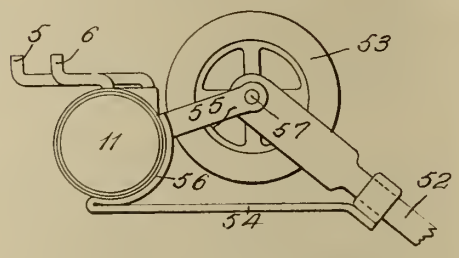



Fig. 5.—Elevation of Switch.

contact plates instead of one, thus correcting the mistake resulting from one switch-thrower failing to do its work.

When the end of the route is reached the motion of the switch is simply reversed by the positions of the switch-throwers, and if a "belt line" (i.e., where the trolley pole is not reversed) the switch throwers on the return line are opposite those of the up line.

The switch throwers are made of pressed steel and are placed over the bolt of the ordinary trolley wire hanger, but are insulated from the wire. The switch is entirely enclosed in a cover which serves as guide or stop to the trolley pole should the wheel jump the wire. The power will go off, of course,

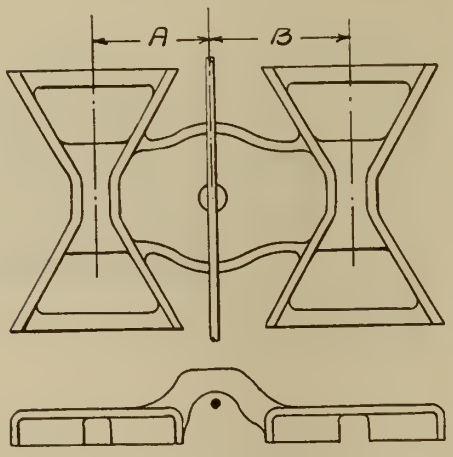



Fig. 6.—Switch Thrower.

but there is no jamming and banging of the pole against cross wires, etc., as the cover of the switch holds the pole within an inch or two of its normal position. This cover is also wholly insulated.

Figure 6 shows the relative size of the switch and a standard trolley wheel.

The indicator board contains the names of the streets or stations on celluloid or glass, with the lamps behind, so partitioned off that only one name will be illuminated at any time, which makes the reading of the indicator instantaneous. The indicator can be seen from any seat in the car, and readily read.

Fig. 8 is the wiring diagram. It will be seen that the power is taken from the trolley pole and passes through the binding post (44) on the drum (9) and thence to the circuit-maker. The plates (16 and 17) are made of insulating material and act as a crank fastened to

Fig. 7.—Series of Switch Throwers.

the shaft (14) to carry shaft (31) and rotate the circuit maker.

From the circuit-maker the current passes through the contact plate to the corresponding lamp in the indicator board and thence to a common line, then through the resistance to the rail.

The instalation of an indicating system of this kind facilitates the movement of passengers, besides catering to their convenience. Passengers being fully prepared to alight when their stopping place is arrived at, will not

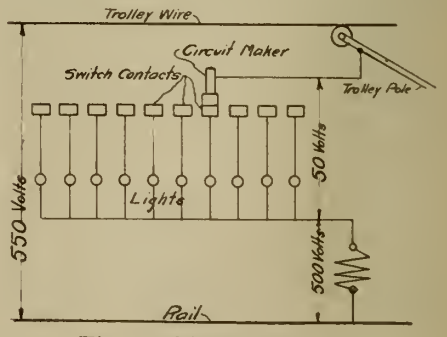



Fig. 8.—Wiring Diagram.

keep the car standing still so long. Apart from the above is the range of possibilities for advertising that this system would introduce. For instance, Brown, whose store is near 10th Street, could have an electric advertisement which would be thrown in circuit the same instant that 10th Street was shown up on indicator board. The revenue from such advertising would soon pay for the instalation.

# Engines and Their Selection for a Small Power Plant

## Various Types of Engines Now in Use, and When it is More Economical to Instal One Type in Preference to Another, with Tests and Cost Data.

By LOUIS P. ZIMMERMAN

In the construction of any engineering work there are two ways in which the work may be done: (1) The ideal way, or the way in which it would give the best returns and best efficiency. (2) The construction actually put up as finally limited by the actual limitations of the situation.

So in the selection of the engine or engines for a power plant, though in itself the most important item after the plant itself, we have to be limited by two things: (1) First and primarily, the amount of money available for our use. (2) The operating and local conditions of the plant. There are in general the following kinds of power units: wind mills, gas or oil engines, water wheels, steam engines and steam turbines, that we can use for various classes of plants.

Water power plants must be considered when near a water supply, or at least so near that the water can be profitably transmitted to a place where it can be used. The great advantage in water power lies in its cheapness; but it has the disadvantage of being hard to regulate on a variable load, and is in most cases unreliable during periods of low water, thus necessitating the auxiliary steam plant which makes rather a costly equipment. The investment for water installations running up to $200 a k.w. for ordinary conditions. A water wheel is good on a steady constant load having a load factor of more than 25 per cent. Below this the fixed charges make it almost prohibitive. At a load factor of 50 per cent. power by water costs about .7 cents per k.w. hour.

In inland plants we have two principal sources of power, viz.: steam and gas producers. The gas engine is the most prominent rival of the steam engine, since in many plants we get a k.w. hour for 1 lb. of coal. The chief objection to them is that they cannot be satisfactorily overloaded and must hence have a larger h.p. instalation, which large units do not run economically at low loads. In districts where natural gas or gas from smelters is obtainable, gas engines have undisputed rights. Probably we shall see such districts soon generating large quantities of power and transmitting it, much as our large water plants do now. In the Bessemer branch of the Carnegie steel mills they have gas engines consuming the waste gases from the smelters. These gas engines are compound, direct connected to air compressors, and the cylinders are internally water cooled, making a very effective and cheap running engine. In small stations of more or less continuous operation, producer gas plants are giving good economy and satisfaction.

**Steam Engines and Steam Turbines.**

Turbines are now built low or high speed, varying from 1,100 to 10,000 revolutions per minute. They may be direct connected to a high speed generator, and a high speed generator of the same size is much cheaper than a low speed one, thus saving in the first cost of electrical machinery.

The plan of putting low pressure steam turbines in the exhaust of a prime mover of large size, is used in rolling mills and mining machinery to give a constant speed for driving the generators of the plant. These low pressure turbines run of 25 to 30 pounds of steam per minute.

The type of engine is generally selected by the size: Large engines are usually compound and low speed. Small ones are simple and high speed. A vertical engine is usually chosen to save floor space. In general practice, below a 50 h.p., a compound does not pay; since the chief economy in a compound is first in its low steam consumption, and second in the greater number of parts, thus making the repair bill less.

For comparison we note the following performance of a simple non-condensing 15 h.p. engine at 280 r.p.m.: Steam pressure, 75 lbs., 95 lbs., 115 lbs., 135 lbs; pounds of steam per 1 h.p., 32.3 lbs., 29 lbs., 28.3 lbs., 27.4 lbs. The chief objection to a small engine running at high speed is the great range of temperature due to the high speed and the large loss of cylinder condensation. Again, in a multi-cylinder engine we have a more equal distribution of the strains due to the piston rods being set at an angle to each other, thus giving a steady rotative motion and preventing the flickering of lights sometimes seen in very bad cases.

The following are figures on the test of small plant, consisting of a 100 h.p. engine for 300 days at 16 hours a day gave 6 pounds of coal per 1 h.p. when run non-condensing. The same engine gave only 4 pounds of coal per 1 h.p. when run condensing for the same period of time under the same load conditions. For the time stated this gave a saving of 480 tons of coal, which at $2 per ton is $960, and at $3 per ton, $1,440. Thus the cost of coal may determine for the particular location whether or not a condensing system should be used.

The cost of operation of a condensing plant is less than non-condensing if we can get a large quantity of cooling water, or have some way of cooling that which we have. The amount of water depends on the vacuum and temperature. In general we have to use 15 to 20 times the amount of water for cooling that we do for feed water. But as we can reduce the feed water one-third we must have only 12 to 15 times the feed water.

Engines are simple, compound, triple and quadruple expansion according to number of times they expand the steam. An increased saving is effected with multi-cylinders by reducing the cylinder condensation by preventing excessive changes of temperature in any one cylinder. A multi-cylinder engine gives us a practicable way of increasing the number of expansions of steam, which gives a gain, since the steam is emitted at nearly zero pressure. The gain per cylinder is more when changing from one to two than afterward. The saving is about as follows in amount of coal: Change from 1 to 2 saves ¼ of the coal; change from 2 to 3 saves 1-7 of the coal; change from 3 to 4 saves 1-10 of the coal.

Pounds of steam consumed per 1 h.p. hour:

| Number of cylinders .. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Condensing ... ... ... ... | 24 | 16 | 13.5 | 12.2 |
| Non-condensing .... .... | 32 | 24 | 20.9 | 18.3 |

These figures are for a constant load. The first cost per h.p. of a multi-cylinder engine is greater than for a simple engine and increases with the number of cylinders in increasing ratio, but the lower steam consumption requires less boiler h.p., and so the saving in boiler installation about balances the other extra cost.

Approximate cost per h.p.:

| | Simple non-condensing. | Compound condensing. | Triple expansion cond. |
|---|---|---|---|
| Engines ... .... .... | $10 | $15.00 | $20 |
| Boilers ... ... ... ... | 16 | 9.50 | 8 |
| Condenser ... ... ... | | 6.00 | 4 |
| | $26 | $20.50 | $32 |

From this table we see that the saving in boiler cost partly neutralizes the extra engine cost. When compared to the saving seen before of 480 tons of coal, the first cost is really insignificant but in many cases it is not possible to get the capital for the condensing system, while the coal bills will be paid from day to day without a murmur. As to economy of operation there is little or no difference whether the engine be cross or tandem compound, but the cross compound is usually handier to get at for repairs.

A vertical engine is more costly to construct, but there is less friction and hence a slight saving due to better results per h.p. delivered. Vertical engines are harder to keep clean and take more head room, but proportionately less floor space. For less than 1,000 h.p. there is no advantage, but the advantage increases with the size and for large powers should be used entirely.

In general, the engines built for power plants have a large range of speed for the different types, but the piston speed is nearly the same for slow speed engines have a long piston and high speed ones a short one. The rotative speed for Corliss engines is limited by the valve construction, which being gravity closing, must have more time to close than the valves of an automatic. Other things being equal a higher speed gives a better economy, since there is less loss by radiation and cooling of cylinder, but the steam distribution is poor, which more than makes up for the gain. The Corliss valve gives a quicker closing and hence a better economy than the slide valve.

Change of load affects the economy of an engine to a very large extent. At certain loads on every engine there is less steam used than at any other load either above or below this load. With a light load the steam expands a great many times, which is in itself a gain, but there is a large condensation due to the excessive change of pressure, which more than compensates the aforesaid gain. All engines have a point of greatest economy. For condensing engines this is at 6 expansions of steam; non-condensing, 3 to 4; compound, 20; and triple expansion, 30. For light loads the Corliss is uneconomical. In general we note the following: If an engine at 100 per cent. load costs 100 per cent. to run, an engine at 150 per cent. load costs 125 per cent. to run; an engine at 50 per cent. load cost 150 per cent. to run. So it is better to have the engine too small than too big, if it will carry the peak load at all. There is less variation for a change of load with a high grade engine than for a low grade non-condensing one.

**Selecting Engine.**

To intelligently select the best type of engine it is necessary to compare the engines as to their operating costs under commercial conditions, which costs depend on the fuel cost per year plus the fixed charges per year. The fuel cost can be obtained when the steam consumption is known. But for calculating the fixed charges on a plant and engine it is necessary to know the first cost, for it has been found that the fixed charges vary approximately with the first cost. In general practice the following types of engines are used:

(a) Simple automatic, non-condensing, slow, medium and high speed.

(b) Simple Corliss, condensing.

(c) Compound automatic non-condensing.

(d) Compound automatic, condensing.

(e) Compound Corliss, condensing.

(f) Triple expansion Corliss, condensing.

Assuming that one pound of coal will generate 8 pounds of steam we have for the annual fuel cost this equation:

$$\text{Cost} = \frac{P \text{ H.P. } hc}{8 \times 2{,}000}$$

where P is pounds of steam per 1 h.p. hour; H.P. is horsepower; h is hours run per year; c is cost of coal per ton.

If we plot this equation for various loads and total costs we can get the fuel and cost at any load. Now the other cost to consider is fixed charge, which is best taken as a per cent. of the total cost.

| | |
|---|---|
| Taxes | 1.5 per cent. |
| Interest | 5 per cent. |
| Depreciation | 5 per cent. |
| Maintenance | 2 per cent. |
| Insurance | 1.5 per cent. |
| | 15 per cent. |

These values may not be correct for every plant, but by comparison are near enough. These charges include only those which depend on first cost, and do not depend on location, conditions of labor, etc. To obtain the first cost of a plant we may use C. A. Benjamin's formulae:

| | | | |
|---|---|---|---|
| 1—Fire tube boiler | 100 | + 6.5 | H.P. |
| 2—Water tube boiler | 500 | + 9.5 | H.P. |
| 3—Boiler setting | 300 | + .75 | H.P. |
| 4—Simple automatic engine | 300 | + 2 | H.P. |
| 5—Non-condensing, simple Corliss | 300 | + 8 | H.P. |
| 6—Compound automatic, condensing | 1,000 | + 10 | H.P. |
| 7—Non-condensing, compound automatic | 1,000 | + 15 | H.P. |
| 8—Compound Corliss, condensing | 1,000 | + 15 | H.P. |
| 9—Triple expansion Corliss, condensing | 2,000 | + 13 | H.P. |
| 10—Condensers | 500 | + 1 | H.P. |

The cost in dollars is thus given by a constant plus a constant times the h.p. rating of the part. In calculating boiler h.p., 30 pounds of water evaporated per hour is considered a b.h.p. Comparing results obtained by using these formulae show that with full load the more expensive and efficient engines are the more economical in running, but as the load factor becomes very low the advantages of these engines over cheaper and less economical engines becomes less. Also, the results seem to show that for coal less than $1.50 per ton, the cheap engine is the more economical even at fairly high load factors, while the efficient engine is best only at very high load factors. However, when the cost of coal is very great, the load factor at which it is better to use the expensive engine is very low. But when the first cost of engines are about the same with different efficiencies, it is of course advisable to choose the more efficient, as the reduced cost of fuel will cause a noticeable decrease in the total operating cost. A compound Corliss is about 25 per cent. cheaper than the triple expansion Corliss of the same horse power, and hence is cheaper to operate in all cases where the cost of coal is less than $3 per ton. With the coal cost at this figure the triple expansion is cheaper at load factors above 55 per cent., all of which goes to show the importanee of the efficiency of the engine and the coal cost relatively to each other. With high priced coal it is worth while saving fuel even at increased cost of plant. But with cheap coal, care must be taken not to burden the plant with high fixed charges since the waste of coal may not be as great as the amount saved in the fixed charges of a less expensive plant.

The horse-power of engines is determines as follows:

For a power load, the number and size of the motors and time of operation must be known, from which we can get an electrical load curve and our electrical h.p. needed.

For a lighting load take: 1-3 house lights installed; 2-3 store lights installed; all street and public building lights for the total electrical h.p. required.

Knowing your load diagram allow:

Maximum I.H.P. — (Electrical load plus 20 per cent. loss from engine to switchboard) times 125 per cent., since we can overload our engine 25 per cent.

I.H.P. for full load—Electrical load plus 20 per cent. loss.

I.H.P. for economical load—2.3 to ¾ of the full load I.H.P.

In putting in a new plant allow for growth of business from 10 to 50 per cent.

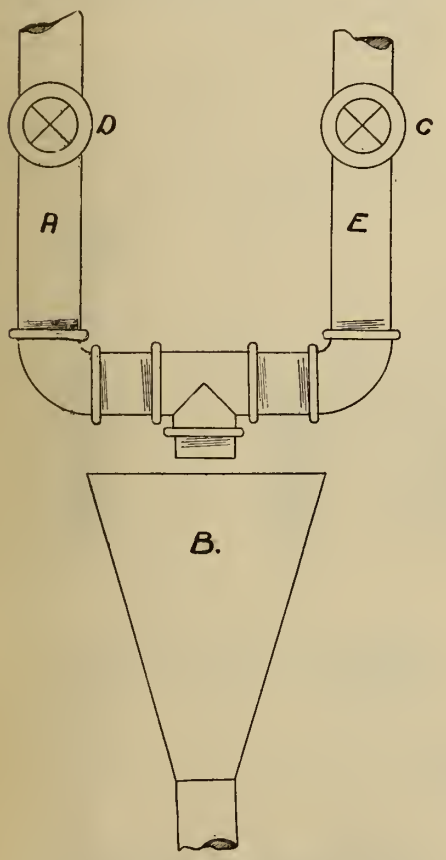
# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## A SIMPLE WATER TOWER APPLIANCE.

By R. D.

No doubt some of your readers have had trouble with an exposed water tank on account of the water freezing. I have a very simple arrangement in use at our plant which relieves me of all anxiety relative to the temperature of the water. The tank is 20 ft. in diameter by 20 ft. in depth and 100 ft. above the




A Simple Water Tower Appliance.

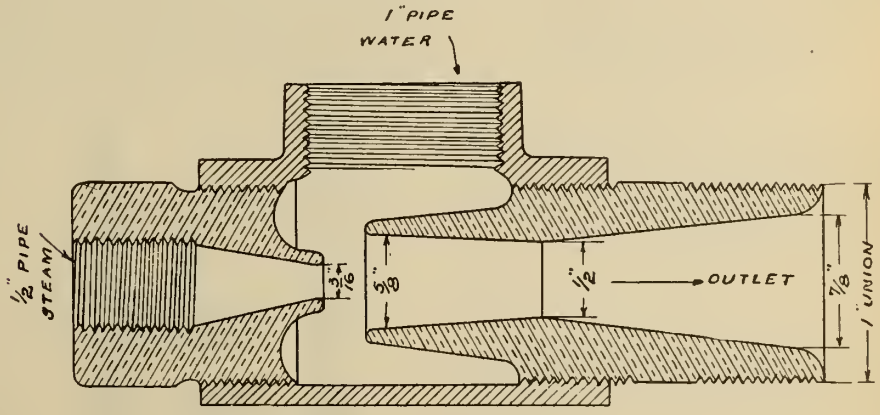
level of the ground floor. A 1-in. pipe carries live steam to a coil of 1¼ in. pipe situated about a foot from the bottom of the tank. This coil is in the form of the largest square permissible in a 20 ft. circle and contains about 70 linear feet. This leads back to the main drip tank, but enters it as shown in accompanying diagram. The pipe marked A rises in the tank to within about six feet of the top, and from the bottom of the tank it delivers to the main drip tank through the funnel B. By closing valve C and opening valve D the temperature of the water in the tank can at all times be ascertained by holding a thermometer in the flow.

The amount of condensed steam returning by pipe E can be easily seen and therefore the flow of steam through the heating coil in the tank can be acurately regulated, and made to suit the weather conditions.

Hoping this will prove of interest.

## ONE-INCH SIPHON.

The accompanying sketch shows a one-inch siphon that was made very simply. A one-inch malleable T was used and




One Inch Siphon.

a water pipe screwed in as shown. The other two parts are made of brass and turned in a lathe. The arrangement is inexpensive and gives good satisfaction.

## SOME REPAIRS AT SEA.

By Eight Bells.

During an experience of some years in deep sea steamers, I have assisted in the carrying out of some emergency repairs which may be of interest to your readers.

The first that comes to my mind is the case of a burst donkey boiler stop valve. This valve was one of the combined type made by Owens, Manchester, England, in which the safety valve and stop valve are contained in one casting, as shown in the accompanying sketch. The donkey boiler was located on the main deck, some height above the main boilers, and the steam pipe was carried from the donkey boiler to the bridge deck, where the valves were located for the fore and aft winches. The auxiliary steam pipe from the main boilers was brought through a reducing valve to a T, where it met the pipe from the donkey boiler, as shown in sketch.

When at sea, the donkey boiler was of course laid off, and if steam was required for deck purposes, it was taken from the main boilers. As there is very seldom any use for winches at sea, quite a quantity of water collects in these pipes, and if the valves need to be opened, it has to be done carefully. On this occasion we were going into Colombo for orders and as the anchor would have to be dropped, the officer on deck sent down for steam on the windlass. The second engineer was on watch, it being just after 7 bells in the morning, that is 7.30. As he was expecting the "stand by" order, he sent his greaser up to open the deck valve, cautioning him to open it slowly. This, unfortunately, the man did not do, but opened it right up, the result was that the side

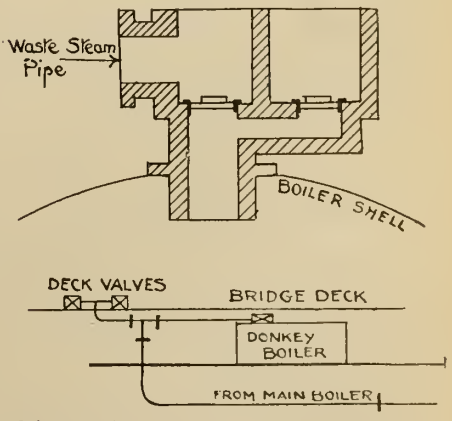



Fig. 1—Showing Boiler Stop Valves.

of the donkey boiler stop valve box was blown out, the resulting explosion and rush of steam giving all hands a pretty

bad scare. Steam was shut off, and a blank flange put in between the valve and pipe for the time being. We then had to find some means of making a repair to enable us to use the donkey boiler in our port of discharge, which happened to be an out of the way place in Japan.

This was achieved by cutting the remaining sides of the box above the valve seat away. We then took the valve seat out, drilled four holes around the hole, tapped them and put studs in. Luckily

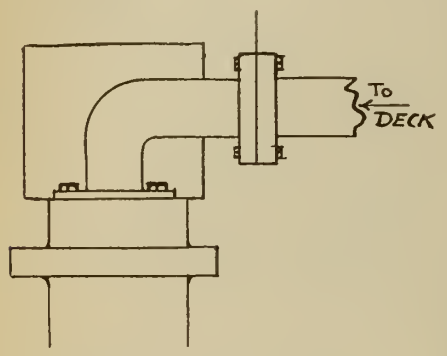



Fig. 2—Showing Copper L.

we had a piece of copper pipe aboard, the same size as the steam pipe. We cut this, and bent it to form an elbow, and put the flange on loose on the end we had cut and riveted the end of the pipe over it. We bolted this L onto the casting where the valve seat had been, and then cut a blank with a piece projecting to form a handle. When we were going to raise steam on the donkey boiler we shut steam off the main, slipped our blank flange out, and were all ready. When leaving port, we kept steam on donkey boiler until steam was showing on the main, then blew her down, put our blank in again, and open-

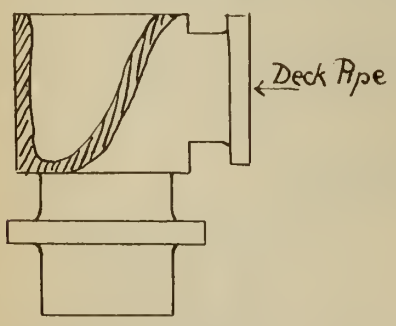



Fig. 3—Stop Valve Box.

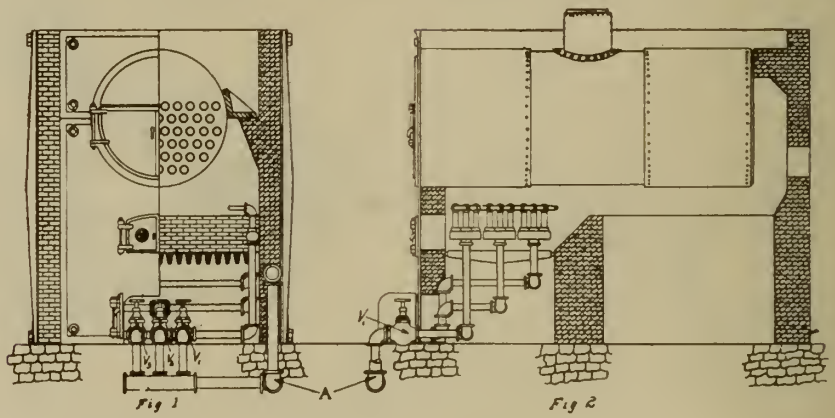
ed steam from the main. This repair worked A1 till we got home, and could get a new casting. We visited several ports in the meantime.

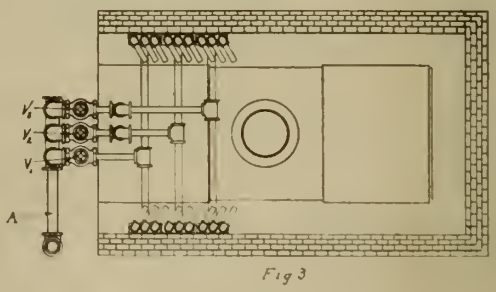
On another occasion we ran all the white metal out of our high pressure crank pin bearing. We had no spare brasses aboard, but lots of white metal. The pin was 12 inches in diameter, and the same length between the webs. We took the lagging (sheet iron), off one of the winch cylinders, and a very little bending brought it to very near the required radius. We then laid three strips of wood, the thickness of the white metal, between the sheet iron and the brass, and bolted the iron to the brass by a bolt through the oil hole. This bolt also formed a core for the oil hole in the white metal. Three fire bars were made red hot, and laid against the brass to warm it up. The brass stood up on end in fire clay to prevent the metal running out on the bottom. When all was ready the metal was poured in. After cooling it was scraped, filed and bedded down on the pin. The whole job took about six hours, which was pretty good, considering it was done at sea.

## NATURAL GAS FOR FIRING A BOILER.

J. H. R., Hamilton.

Gas is used extensively in the shop where this method is in operation and they seldom have occasion for a heavy fire, as the steam generated is only used for heating purposes. The firebox was




Natural Gas for Firing a Boiler.

piped in the way shown and by using one or more of the valves, a light, medium or heavy fire is obtained. The grates are covered by sheet iron and if at any time the gas should fail it would be an easy matter to remove the sheets of iron when the firebox is ready for coal.

Fig. 1 shows a front elevation, partly in section, Fig. 2, a side elevation in section on the centre line, and Fig. 3 a plan of the piping in position.

A is the main pipe leading to the valves V1, V2 and V3. The piping from V1 leads to the first three feed-pipes on each side; V2 to the second three pipes on each side, and V3 to the last three feed pipes on each side.

While the gas is considerably cheaper than the coal, it is also quite a bit cleaner and handier, having no coal to shovel or ashes to haul away.

## ONE WAY TO RAISE THE RATE OF EVAPORATION.

By Mac.

In my plant we weigh our coal and meter the boiler feed water and get an evaporative rate of between 11 and 12 pounds of water per pound of coal—the water entering the boilers at a temperature of between 212 and 215 degrees. During a shut-down changes were made in the power end of the plant with a view to doing a bigger trade and carrying a heavier load.

After starting up again the daily coal consumption was higher. This was to be expected, as we were now using about 150 engine h.p. to do the work that had formerly been done easily by about 250 h.p. This meant greater waste of steam in the engines through condensation, and there was also increased friction. We were using more steam in other manufacturing processes also. Our daily water consumption increased, but the rate of evaporation fell off discouragingly, until it was down to about 6 pounds.

One morning the meter was on strike and an examination showed a bit of pump packing stuck in it. Incidentally it was found that an internal joint was blown out, allowing a great deal of the water to pass around the meter. After

fixing up everything went smoothly again with a rate of evaporation between 11 and 12 pounds.

## PIPES AND TUBING.

The last paragraph of the article under this heading on page 29 of the December issue should read as follows.

In determining the diameter of a steam pipe a common method is to allow a steam velocity of 6,000 feet per minute. The resistance to the entrance of a pipe may be taken equal to a straight length, equal to 60 times the diameter, the resistance of a sharp elbow 40 times the diameter, and of a globe valve, 60 times the diameter. Allowing 40 lbs. of steam per h.p. per hour for a steam engine and 6,000 ft. per min. velocity, then

$$H.P. = 6d^2 \text{ or } d = \sqrt{\frac{H.P.}{6}} = .408\sqrt{H.P.}$$

## NOVEL USE OF COMPRESSED AIR.

By Alex. Whyte.

In an engineer's experience, he continually meets new obstacles which must be overcome. The overcoming of a difficulty has resulted in an interesting application of compressed air which has been adopted by the Niagara Power Co. As compressed air equipment is to be found in nearly every power plant it will be possible to apply it in the manner used by the above company where the saving of time is an important item.

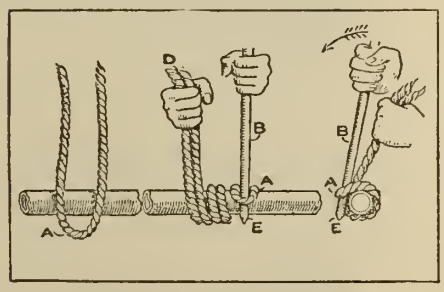
In the Toronto Terminal Station it was necessary to put a wire through a conduit from an upper switch board to a lower one, a distance of about three hundred feet. The method of utilizing compressed air was discovered after an unsuccessful morning's work trying to get the "fish" wire through. This wire is used as a leader to draw through the insulated copper wire, but on this particular morning the wire could not be put through, past the joints and curves.

Some method had to be used that would get the wire through without any further waste time, and it was decided to try compressed air. The conduit was ¾-inch in diameter. A solid rubber ball with a diameter of about ½-inch, or slightly less than the conduit, was procured. A hole was made in the ball and a strong cord was pushed through and firmly attached to it. It was then dropped into the pipe and the nozzle of the hose from the compressed air tank was inserted in the conduit. The air valve was turned on, there was a rush of air and the ball with the cord attached was blown halfway across the floor. It took only a few seconds for the ball to be blown through the conduit, past the twists and curves.

The rest was comparatively easy. The cord was fastened to the "fish" wire, which, in turn, was fastened to the insulated copper wire. It was easily drawn through after that. The Niagara Power Co. have adopted this method altogether for putting wire through conduits with joints and curves. Nearly all power plants have compressed air equipment for blowing the dust from generators and electrical apparatus and this easy method of putting wire through conduits can be adopted. A great deal of time will thus be saved.

## TURNING PIPE WITHOUT WRENCH.

A piece of rope makes a good substitute for a pipe wrench if used as shown in the accompanying sketch. Double the rope and form a loop, A, in the middle and wind it around the pipe a couple of turns, pass a bar or piece of pipe, B, through the loop with its end, E, against the pipe as shown.




Will Not Crush the Pipe

Hold the end, D, of the rope tant and push the handle end of the bar in the direction as shown by the arrow. This will tighten the rope and make it grip the pipe which will turn in the direction the bar is pushed. Slack up on the bar and rope and bring them back again to the first position for another grip. Repeat the operation until the pipe is turned out or in. This device will turn a pipe as well as a pipe wrench and will not crush the pipe.

## WHO'D HAVE THOUGHT IT?

By Mac.

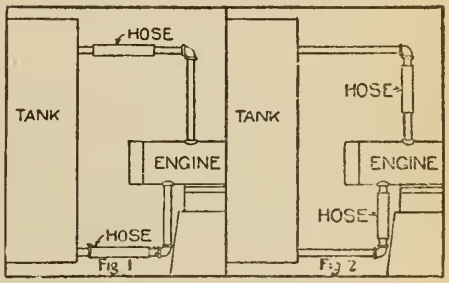
I was visiting in Montreal about three weeks ago and heard the following story which is too good to keep:

It happened at one of our large generating plants and a green helper was the originator. He had been taken on only a few days previously and was assigned the duty of taking hourly temperatures of the oil in the large water-cooled oil transformers.

One day the operator cut out a bank of transformers, without, of course, seeking the advice of the helper. Naturally the temperature of the oil rapidly dropped and after an hour or so the helper came into the operator with a most troubled expression and when asked what was worrying him, announced, "I don't know what is the trouble. I've shut off all the water, but I can't keep those three boilers warm."

## GAS ENGINE CONNECTIONS.

In ordinary practice it is customary to attach the hose on the horizontal pipes as shown in Fig. 1. This is found to be very unsatisfactory as the vibration of




Improved Hose Connection

the engine works the hose loose and the hose soon cracks. By inserting the hose on the vertical pipes, as shown in Fig. 2, this trouble is eliminated and the life of the hose is much longer.

## SOME RULES WORTH KNOWING.

Diameter multiplied by 3.1416=circumference.

Circumference multiplied by .3183=diameter.

Radius multiplied by 6.2831=circumference.

Square of the diameter multiplied by .7854=area.

Diameter multiplied by .8862= side of equal square.

Area of a rectangle=length multiplied by breadth.

Side of a square multiplied by 1.128=diameter of circle of equal area.

Surface of a sphere=square of diameter multiplied by 3.1416.

Area of a triangle=base multiplied by ½ the altitude.

Area of a sector of a circle=one-half the length of the arc multiplied by the radius of the circle.

One cubic foot of water weighs 62 1-3 pounds and contains 7½ gallons.

One gallon of water (U. S. standard) weighs 8 1-3 pounds.

To find the capacity (U. S. gallons) of cylindrical tanks, square the diameter expressed in inches, multiply by the length and by .0034.

The pressure of still water in pounds per square inch against the sides of any pipe, channel or vessel of any shape

whatever is due solely to the "head" or height of the level surface of the water above the point at which the pressure is considered, and is equal to .43302 lb. per square inch or 62.355 lbs. per square foot for every foot of head.

Boiler Horse Power—The evaporation of 30 lbs. of water per hour, from a temperature of 100 degrees F. into steam at 70 lbs. gauge pressure.

One pound of water evaporated from and at 212 degrees is equivalent to 965.7 British Thermal Units.

To find the number of square feet of heating surface in tubes—Multiply the number of tubes by the diameter of a tube in inches by its length in feet, and by .2618.

To find safe working pressure of boiler—Multiply 1-6 of tensile strength of plate by the thickness of the thinnest plate in inches and divide by ½ the diameter of the boiler. This is for single riveting, to which add twenty per cent. for double riveting when all the holes have been drilled.

In calculating the horse power of boilers the following proportions of heating and grate surfaces for each horse power are generally accepted as approximately correct. In plain cylindrical boilers, 15 sq. ft. of heating surface and 1 sq. ft. of grate surface; in flue boilers, 15 ft. heating surface and ¾ sq. ft. grate surface; in tubular boilers, 15 to 16 sq. ft. of heating surface and ½ sq. ft. of grate surface. A little more grate surface, however, will give better results.

The feed water required by small engines is a useful thing to know. In columns A is given the pressure of the steam in boiler indicated by the gauge. In columns B is given the pounds of water per effective horse power per hour.

| A | B | A | B | A | B | A | B |
|---|---|---|---|---|---|---|---|
| 10 | 118 | 30 | 93 | 70 | 71 | 120 | 61 |
| 15 | 111 | 40 | 84 | 80 | 68 | 150 | 58 |
| 20 | 105 | 50 | 79 | 90 | 65 | | |
| 25 | 100 | 60 | 75 | 100 | 63 | | |

Doubling the diameter of a circle or pipe increases its area or capacity four times. Friction of liquids in pipes.

To evaporate one cu. ft. of water requires the consumption of 7½ pounds of coal, or about one pound of coal to one gallon of water.

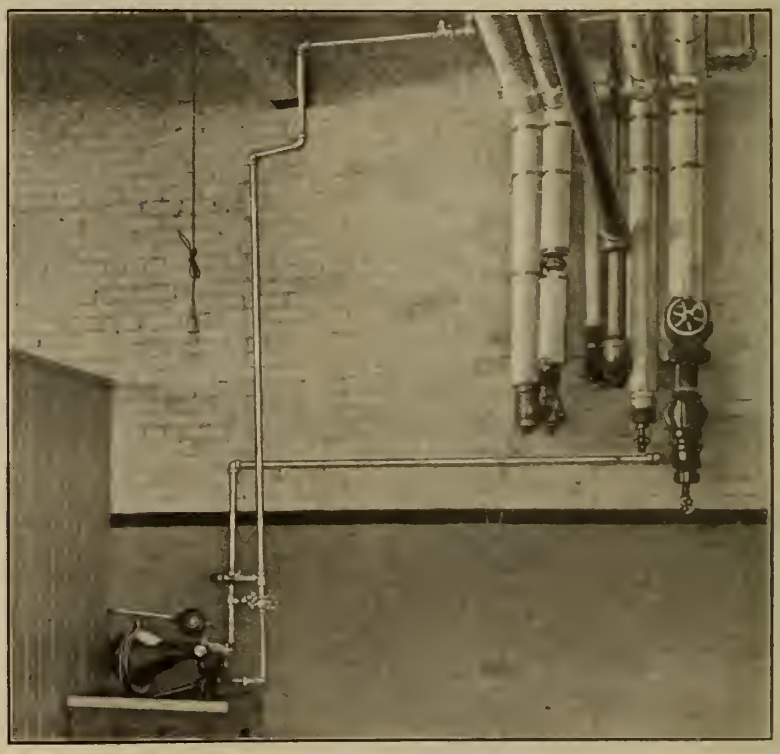
The average consumption of coal for steam boilers is 12 pounds per hr. for every sq. ft. of grate.

The economical speed of shafting for machine shops has been found to be from 125 to 150 revolutions per minute, and for wood shops from 200 to 300 revolutions.

## A TRAP INSTALATION.

By A. E. D.

The new laundry of the Standard Shirt Company, Montreal, was well under way and the concrete floor almost completed when it was discovered that a tunnel for steam and water pipes under the floor had been overlooked. To tear up the concrete to make the tunnel would have been very expensive on account of the length of the building, 325 feet, so it was suggested that the pipes be all run over head. This was thought to be hardly feasible on account of the trapped water having to be lifted from each set of machines at the floor to the pipe over head. A test of a small Bundy trap was made and this trap lifted the condensed water 60 feet vertically. A test was also made to determine the efficiency of one of these traps on the drying room pipes. The result was that the linen could be put through the dry rooms fifteen minutes faster than before, showing that there was less water of condensation lying in the steam pipes and, therefore, less heat absorbed by that water.



A Trap Instalation Showing Pipe Arrangement.

The steam enters the building through a 4-inch pipe, 175 ft. from the boilers; inside the building the size changes to 3 in., and the first trap of the system is placed near the floor at this point, returning the condensed steam up again to the return pipe, which is on the same level and hanger as the steam. The steam for each ironing machine, washer, dryer, etc., is taken from the top of the steampipe, and there is a trap to each set of machines. These traps are all situated on the floor and the interesting point is that they actually pump the water against the distance between the floor and the overhead return pipe. There is a pressure of 85 pounds at the boilers and a steam gauge placed in the steam line about half way of the building from the steam entrance showed a loss of about one pound. This is remarkable in itself and speaks volumes for the rapidity with which the pipes are emptied of water keeping the steam dry and the pressure up.

From an engineering point of view this is nearly an ideal instalation. There are no hidden nor closed in pipes or valves, everything is right at hand and a leak or defect can be instantly noted.

## LAYOUT OF LONGITUDINAL JOINT OF BOILER.

By A. G. Arkwell.

I figured out a longitudinal joint of a 60 in. boiler for 150 lbs. working pressure, and it will probably be of interest to many readers.

There are two different joints, a lap and a butt joint, and I have figured it for both. To begin, I assumed the plate to be 7-16-inch thick, with a treble riveted lap joint, and figured through to see if I could allow 150 pounds.

The pitch of the rivets was found from the following formula:

$$(C \times T) + 1\frac{5}{8} = p$$

where T=thickness of plate in inches
p=maximum pitch of rivets in inches;

c=constant depending upon style of joint and number of rivets in one pitch in this case c=3.47.

Substituting in the formula we have: (3.47×.4375)+1⅝=3.143 or 3 9-64 in.

In order not to draw the line too finely I considered it better to make the pitch 3⅛ in. There is another reason why the

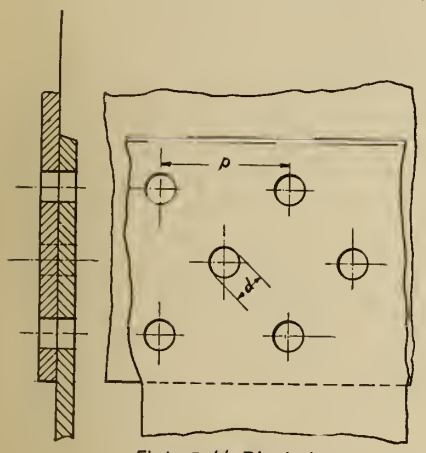



Fig 1. Treble Riveted Lap.
The Power House.

pitch should not be too large, and that is that it would be difficult to keep the joint tightly caulked, although it would be strong enough to resist breaking.

Having found the pitch I next figured the percentage strength of the plate and rivets at the joint as compared with the solid plate.

The percentage of plate is:

$$\frac{p-d}{p}\times 100 = \%$$

d=diameter of rivet when driven, or, in other words, the diameter of the rivet hole. Substituting we have

$$\frac{3.125-.9375}{3.125}\times 100 = 70\%$$

using ⅞ in. rivets. Using ¾ in. rivets this becomes 73 %.

In figuring the percentage strength of the rivets I took into consideration the factor of safety. This factor varies with the style of joint and grade of workmanship. For a joint having all holes drilled in place the factor would be 4.07.

Then the percentage strength of the rivets is found from the following formula:

$$\frac{100\times A\times n\times 23\times F}{4\times 28\times p\times T} = \%$$

Where A=area of driven rivet
n=number of rivets in one pitch
F=factor of safety
p=pitch of rivets in inches
T=thickness of plate in inches

Substituting we have:

$$\frac{100\times .6902\times 3\times 23\times 4.07}{4\times 28\times 3.125\times .4375} = 126\%$$

for the percentage strength of rivet section which shows we could use smaller rivets. Figuring for ¾ in. rivets and using same formula we get 95%.

Having found the percentage strength of the joint I used the smaller of the two in figuring the working pressure from the following formula:

$$\frac{ts\times r\times 2T}{D\times F} = B$$

Where ts=tensile strength of plates
T=thickness of plate in inches
D=inside diameter of boiler in inches
F=factor of safety
r=lowest percentage divided by 100
B=working pressure in pounds per square inch.

Substituting we have:

$$\frac{60{,}000\times .73\times .875}{60\times 4.07} = 156 \text{ pounds per sq. in.}$$

This shows us that we have a margin of allowable pressure over and above that which we are going to use.

The distance between the rows of rivets is more or less arbitrary. In this case it is about 1¾ inches. The distance of the centre of the rivet from the edge of the plate is 1½d.

I also took the treble riveted, double butt strapped joint and figured that through. As we can get a much better percentage of plate in this joint and a lower factor, I took a thinner plate ⅜ in. Referring to Fig. 2, it will be noted that in the outer row of rivets every other rivet is omitted. This is done to increase the percentage strength of the plate. These rivets do not go through the outer straps for the reason that the large pitch would allow the strap to bend between the rivets and thus make caulking difficult.

In figuring the pitch we do not take into consideration the outer row, but figure the pitch for the second row as though the joint was simply double riveted.

Then the pitch will be

(350×.375)+1⅝=2.9375 or 2 15-16 in.

The pitch of the outer row will then be 2p or 5⅞ in., and the percentage strength of plate will be

$$\frac{5.875-.8125}{5.875}\times 100 = 86\%$$

In figuring the percentage strength of the rivet section we do it in two steps. First, find percentage strength of the two inner rows, which are in double shear and add this to the percentage of the outside row which is in single shear.

Then for inner rows we have

$$\frac{100\times .5184\times 2\times 23\times 4.0}{4\times 28\times 2.9375\times .375} = 77\%$$

Note the change in factor of safety from 4.07 to 4.0 for double butt strap joints having all holes drilled in place.

For the outer row we have

$$\frac{100\times .5184\times 1\times 23\times 4}{4\times 28\times 5.875\times .375} = 19\%$$

the total for both outer and inner rows being 96%.

There is one more percentage to be found for this style of joint before figuring the allowable boiler pressure and that is the combined percentage of plate and rivets. This is the sum of the percentage of plate at inner rows and the percentage of rivets at the outer row.

Percentage of plate at inner row

$$\frac{2.9375-.8125}{2.9375} = 72\%$$

Then the combined percentage is 72+19 =91%.

The allowable boiler pressure is now worked out the same as in the lap joint, using the smallest of the three percentages—

$$\frac{60{,}000\times .86\times .75}{60\times 4.0} = 161 \text{ pounds per sq. in.}$$

This is ample margin. If the workmanship were poor the factor of safety would be increased which would bring down the allowable working pressure. The butt straps should be at least five-

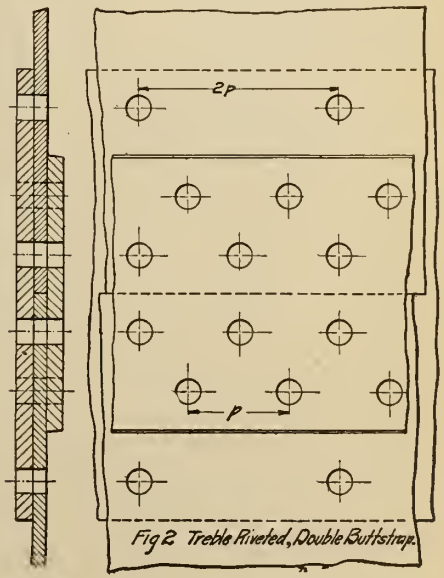



Fig 2 Treble Riveted, Double Buttstrap.

eighths of the shell thickness, but it is considered not good practice to have them less than ½ inch thick for caulking reasons. These two joints have been figured according to British Columbia laws.

---

Everybody is of some use in the world. The whistle isn't needed to make the engine run, but still it's needed.

## CORRESPONDENCE.

We welcome discussion on articles appearing on the previous pages. Perhaps they suggest some experience you have had. Write us about it in your own way. We will prepare it for publication and will remunerate you for it. If you have difficulties we would be pleased to have you write about them to us and we will publish them in The Power House. Your name will be withheld if you do not wish it published.

We invite engineers to send in answers to questions asked. We pay for these also. Address, The Power House, 10 Front Street East, and it will reach the editor.

---

### Gas for Tempering.

Editor Power House,—Mr. Dormer hasn't given full information regarding his apparatus for hardening dies. The sketch shown in the December Power House is for burning gas under a boiler. The following methods illustrate the use

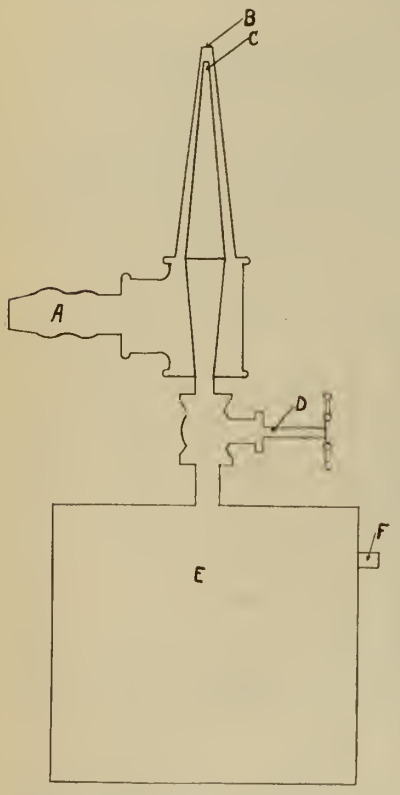



Fig. 1—Gasolene Burner.

of gasolene or gas for hardening small punches or dies.

Fig. 1 illustrates the apparatus arranged for gasolene. A is the pipe to admit the gasolene. B is the nozzle for gasolene, and should be .002 in. The tank E should be at 50 lbs. pressure. The nozzle C should be made so that there are eight volumes of air to one of gas, following Boyle's law, the volume of a given mass of gas varies inversely as the pressure provided the temperature is kept constant. At F is a check valve to retain air pressure in tank.

Fig. 2 illustrates the method of using gas for tempering small punches, taps, reamers, chisels, dies, etc. A is the outside cast iron shell which is lined with asbestos. In it is a hole through which the punches, etc., to be tempered are dropped.

B is the nozzle of a one-eighth inch pipe with an opening=.03758 in. diam. C is the one-eighth pipe. The opening

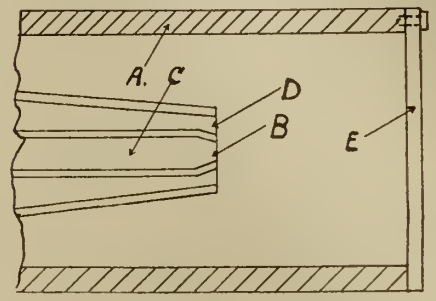



Fig. 2—Gas Burner.

D for air=.019635 in. when air is at 100 lbs. pressure as mentioned. E is an annular plate closing the front of the cast iron box or sleeve covered inside with asbestos. This sleeve may be removed and the nozzle may then be used for brazing and flanging.

One of these was used where I worked for reamers, punches, taps, etc., and small reamers using ordinary illuminating gas. It worked very satisfactorily.

JOHN M.

---

### Inquiries From Engineers.

In reply to inquiry from Chatham I might say that corrosion is one of the most destructive agents to which boilers are subjected. It arises from the presence of acids in the feed water which gradually become concentrated as evaporation goes on and combine with the material of which the boiler is constructed causing "pitting" and honeycombing to the most susceptible parts. Under the head of corroding solids we find four very dangerous acids which contaminate feed-water more or less throughout the country. Of these four acids the most dangerous is sulphuric. This element owes its presence to the drainage from coal and ore mines, paper mills, galvanizing works, chemical works, oil refineries, etc., and its presence is denoted by a dark green tinge of the water.

It becomes noticeable in a boiler in an inconceivably short space of time by a red discoloration of the water. This is brought about by the sulphuric acid in combination with the iron of the boiler producing iron sulphate, which is again separated from the water as ebullition goes on and as it is non-volatile a new supply of iron is taken up by the acid and so on until the plates are actually destroyed.

The same condition of affairs exists with nitric, tannic and acetic acids, except in a milder form, and water charged with them should not be used for steam purposes without treatment. The same condition also exists with iron sulphate and alumina sulphate. While they are not so destructive in cold water, yet when heated to a high temperature a separation takes place leaving a concentrated free acid to act injuriously on the plates and tubes of the boiler.

The following is a reply to an inquiry from Hamilton regarding drying by steam heat. Air will absorb moisture until it is saturated, it can be so saturated as to produce a fog and the temperature at which it deposits any excess is known as the dew point. The ordinary basis of calculation for evaporating purposes is that 10 sq. ft. of heated surface will evaporate 1 lb. of water per minute. Hence steam employed for this purpose should be about 242 deg. F. or 15 lbs. pressure. A cubic foot of air at 30 deg. F. will carry off only 2 grains of water, while at 160 deg. the practical limit of heating air by steam, it will carry off 90 grains.

Grains of water that air will take up at different temperatures:

| Degrees. | Grains. | Degrees. | Grains. |
|---|---|---|---|
| 100 | 19.81 | 140 | 56.42 |
| 110 | 26.40 | 150 | 71.54 |
| 120 | 34.16 | 160 | 93.31 |
| 130 | 44.10 | ... | .... |

In reply to an engineer at Hamilton, the analysis of water (Hamilton, Ont.), per 231 cubic inches, i.e., U.S. gallon:

| | Grains. |
|---|---|
| Lime carbonate | 4.11 |
| Lime sulphate | 1.55 |
| Magnesia carbonate | 1.91 |
| Sodium chloride | 1.46 |
| Iron oxide and silica | .37 |
| Volatile and organic matter | 1.80 |
| Total solids | 11.20 |

W. A. CROCKETT.

---

### Muffling the Exhaust.

Editor of The Power House:

Dear Sir,—In your October number I read the very interesting account of how the noise of the exhaust from a gas engine was overcome. This, so the article says, was in connection with a small gas engine. I had some experience along the same line with a larger engine of 85 h.p. and thought it might prove of interest to your readers.

The engine was in the power house of Her Majesty's Theatre, Walsall, England. As shown by the accompanying sketch, the engine was close to the

stage, with only a 9" wall in between and some means had to be devised to silence the exhaust so as not to interrupt the performances on the stage, and as the engine room was next to the street the municipal authorities also demanded that the exhaust be silent.

The first experiment that was tried is shown in Fig. 1. The exhaust pipe was run up through the roof about 6 feet, and suspended centrally over this was a 12" pipe which ran up about 20 feet from the roof and lapped the exhaust pipe about 3 feet, as shown. This proved very effective and reduced the noise about 50 per cent., but was not enough and so the experiment pictured in Fig. 2 was tried. The exhaust was turned down and run into an ordinary open box muffler placed about fice feet underground. From this a pipe led to the bottom of a pit about 6 feet square and 6 feet deep. Inside the pit this pipe led up by an elbow. Two other pipes ran into the pit from above ground, the end of one being close to the bottom and the end of the other close to the top. The pit was covered with a concrete top and the exhaust was silenced to such an extent that one standing over the pit could hardly notice it.

There was also trouble experienced on account of noise from the air intake pipe which was placed as shown in Fig. 1 and had a funnel-shaped mouth. This mouth was taken off and a box-shaped mouth (Fig. 2) was put on instead. After this change no trouble was experienced on account of noise at the intake pipe.

I would like to see an answer to this letter, in this column, from any one of your readers who can give a reason for the effect the change of mouths had on the noise of the air intake pipe.

Yours truly,
OLD COUNTRY.

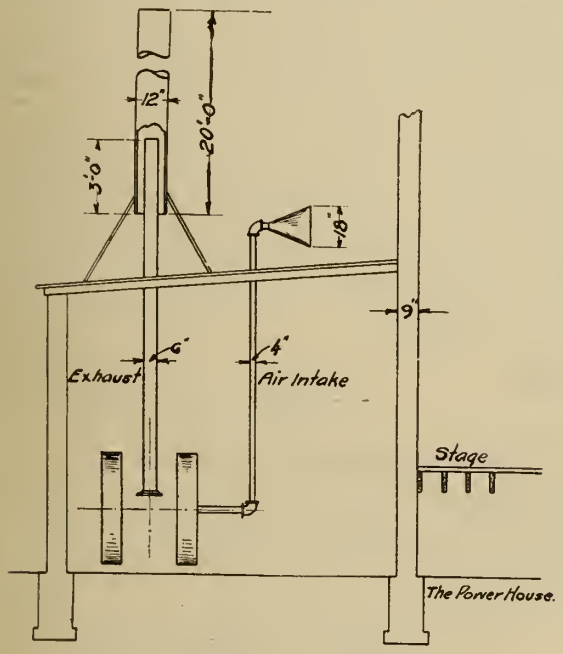



Fig. 1.—First Arrangement.

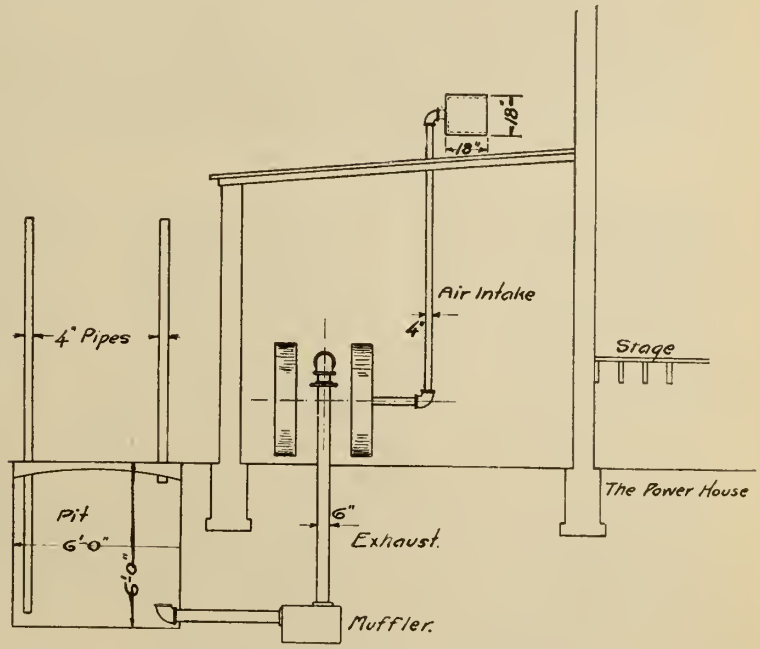



Fig. 2.—Second Arrangement.

### The Boiler Law.

Dear Sir. In relation to having a uniform Boiler Inspection Act for the Dominion of Canada, would say that we are unable to give an opinion as to the feeling of the manufacturers of British Columbia, as we are not manufacturers, but believe a uniform Boiler Inspection Act for the Dominion is almost a necessity, as it will be to the interest of the consumer as well as to the builders, as the consumer might have a boiler that would suit in one Province, and should he wish to use it in another he could not do so. It does seem strange that boilers can be built in foreign countries. not under the supervision of a Provincial boiler inspector, and pass in this country, whereas in Canada an affidavit must be filed, showing this was built under the supervision of a Provincial inspector, before same will be allowed to be put into commission.

THE A. R. WILLIAMS MACHINERY CO., VANCOUVER. C. R. Kennedy, Manager.

### Dissipation of Energy.

Dear Sir: Your problem in the November number of The Power House. regarding the dissipation of energy when a copper spring under compression is placed in H2, SO4, has proved very interesting to me, and I beg to offer the following solution, viz:

Suppose the spring to be under a compression of 100 punds and supose that in its original state it would stand a compression of 200 pounds, then it appears to me that when the cross-section of the spring is reduced to or below a point at which 100 pounds is the maximum, then the spring will break, dissipating the energy in the form of heat and mechanical work.

Trusting to hear further discussion concerning this problem, I beg to remain, Yours truly,
C. D. MONK.

## THE VALUE OF THE EXPERT.

The independent expert is day by day becoming better recognized as an economic factor in our industries. Through his knowledge and equipment he is able at relatively little expense for his services to reduce waste, increase efficiency and overcome difficulties. Take for instance a case as simple as the following:

A power station recently experienced considerable trouble from the breaking of boiler tube cap bolts on their water tube boilers. The bolts looked all right, but every time a boiler was cooled down and brought up to steam again a number of the bolts would break off short. The matter became so serious that several bolts were sent to an expert chemist for analysis and the determination of the same. The chemist, Arthur D. Little, of Boston, immediately discovered that the bolts were made of overheated steel, instead of the best quality of wrought iron—for which the company had paid—and supposed they were obtaining. A change of material at once removed all trouble.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960, J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe, 933-935 Monadnock Block
NEW YORK - R. B. Huestis, 622-624 Tribune Bldg. Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas, 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

## CONTENTS

A Canadian Instalation of Riche Producer Gas Plant - - 9
Advice to Young Men - - 10
Test of Engines Manufactured by Robb Engineering Co - 11
Adoption of Gas Plants in Quebec as a Source of Power - 13
Goldie McCulloch Gas Engine - 14
Alberta's License Law - - 16
Depreciation in Steam Plants - 16
Course of Lessons for the Instruction of Stationary Engineers - - - - - 17
Boiler Compounds - - 18
An Automatic Indicator for Use in Street Railway Cars - - 19
Engines and their Selection for Small Power Plants - - 21
Practical Articles by our Readers 23
- A Simple Water Tower Appliance.
- One-Inch Siphon.
- Some Repairs at Sea.
- Natural Gas for Firing a Boiler.
- One Way to Raise the Rate of Evaporation.
- Novel use of Compressed Air.
- Turning Pipe Without Wrench.
- Who'd Have Thought It?
- Gas Engine Connections.
- Some Rules Worth Knowing.
- A Trap Instalation.
- Layout of Longitudinal Joint of Boiler.

Correspondence - - - 28
The Value of an Expert - - 29
Editorial - - - - 30
Societies - - - - 31
New Equipment for Power Plants - - - - 32
- Myer's Automatic Boiler Cleaner.
- Leonhardt Gauge Glass Protector.
- Ideal Smoke Consumer.
- American Indicator Motion.
- Wattmeter for Alternating Current.
- Wing's Turbine Blower.
- New Type of Pipe Fittings

Power Plant Developments - 35
Power Supply Markets - - 36
Catalogues - - - - 36

## ONTARIO STATIONARY ENGINEERS' ACT.

The applicants who have paid their fees have received their certificates and the remainder will be dealt with in the order received. Already the examiners have held about one hundred examinations in Toronto. One of the examiners has visited Cobalt, North Bay, Sudbury, Sault Ste. Marie and Parry Harbor, and examined the candidates who presented themselves for examination for stationary engineer certificates.

One month's grace has been allowed for making application so that any engineers who have not already made application and who can comply with the regulations should do so at once. Any engineer operating a steam plant of twenty-five horse-power or over may receive a certificate by complying with the regulations. Every engineer operating a steam plant of fifty horse-power or over must have one. Certificates are granted to every engineer who at the time of the passing of the Act (April 20, 1907) holds a certificate of qualification from any association of stationary engineers in the Province of Ontario;

Or who is a holder of a marine or locomotive engineer's certificate;

Or who shall be in charge of any steam plant of twenty-five horse-power or over operating in the Province of Ontario;

Or who has had two years' experience in the operation of twenty-five horse-power or over in the Province of Ontario.

These qualifications allow assistant engineers to obtain their certificates without examination, provided they make application this month. Provision has been made for the sickness or holidays of the engineer in charge, but the assistant engineer should not neglect this opportunity of procuring his engineer's certificate. He will then be prepared when the necessity arises, of taking full charge of a power plant.

For engineers who cannot read, the chairman of the board is providing a model steam plant for the examination of such candidates. The first examinations are simple and comply strictly with the Act, but as the provisions become better understood these will be made more strict.

Any engineer who is not now the holder of a certificate and who may be found in charge of a steam plant of fifty horse-power or over, in the Province of Ontario, is liable to a fine of from $10 to $25, and his employer is liable to a similar fine, with costs in each case.

Engineers and engineer's assistants who have not attended to the obtaining of a certificate should do so without further delay.

## THE ENGINEER WHO READS.

An engineer intimated to a representative of the Power House that he had never subscribed to or read a technical paper, nor read a book on the work of an engineer. Contrast him with another who cannot read yet has his wife read the technical papers to him. In the Ontario Engineers' regulations provision is made for the latter class of engineers, but no sympathy should be shown with the former class. Examiners should investigate and see if the engineer reads and keeps up with the times.

The progressive, practical engineer keeps in touch with the latest developments in power machinery. He reads the technical papers and the latest books. One inexpensive method of keeping in touch with new equipment is to read the latest catalogues. Each month there are reviewed in The Power House many catalogues which contain a fund of information. The publishers of these catalogues maintain a publicity department for the purpose of distributing this literature and will be pleased to send copies of catalogues to any engineer on request. At the cost of only a few cents for postage an engineer can keep informed on every development in the mechanical world.

Peruse the advertisements, the catalogue reviews, the references in the editorial columns to new equipment, and when anything interests you write for the catalogues at once. The advertiser will appreciate such inquiries and you will get information of real value to you.

### MANITOBA BRANCH C.S.C.E.

The first annual banquet was held in Hotel Alexandra, at which about fifty members were present.

Prior to the banquet the annual meeting of the society and election of officers for the coming year was held. J. E. Schwitzer, of the C.P.R., presided at the meeting in the absence of the president of the Manitoba branch, Col. H. N. Ruttan. The election of officers resulted as follows: Chairman, Col. H. N. Ruttan; executive committee, J. E. Schwitzer, J. A. Resketh, C. H. Dancer; auditors, H. A. Bowman, Frank Lake; secretary-treasurer, Prof. E. Brydon Jack.

At the conclusion of the banquet a number of speeches were made by the various members of the society, all of which would indicate that the Manitoba branch of Canadian Society of Civil Engineers is entering upon a successful year with greater enthusiasm than has been heretofore shown.

The toast list was as follows: "The King," "Canada," A. L. Ford; "Manitoba," C. H. Dancer; "Winnipeg." Captain S. Frank Peters; "Sister Societies," S. Hooper and Percy Over, for the architects; George McPhilips and C. C. Chataway for the M.L.S.; "The University," Prof. R. R. Cochrane; "The Railways," M. H. McLeod, J. E. Schwitzer, S. R. Poulin and L. B. Merriman; "Power Construction Department," W. G. Chace.

### CANADIAN ASSOCIATION STATIONARY ENGINEERS.

The December 18th open meeting of the Toronto branch took the form of a smoker, and there was a large attendance. W. D. Archer read a paper on "The Use of Steam in Low Pressure Turbines."

On account of the holidays the meetings for January will be held on 15 and 29, Jan. 29 being the open meeting, to which all engineers are welcome.

The C.A.S.E. is growing and new local lodges are being formed in Sarnia, Strathroy and Dresden. The engineers of North Bay, Winnipeg and Amherst, N.S., are becoming interested in the C. A.S.E. and it is expected that many new lodges will be formed in the next few months.

### A.I.E.E., TORONTO SECTION.

The regular monthly meeting of the Toronto section of the American Institute of Electrical Engineers was held at the Engineers' Club, 96 King Street West, on Dec. 18, 1908. H. G. Stott, Supt. of Motive Power, Interborough Rapid Transit Co., New York, gave a lecture on "The Cost of Power." Mr. Stott brought out a number of interesting points in connection with the various costs in power production for coal and water, mechanical maintenance and operation, etc., and gave some exceedingly instructive comparisons of the costs of reciprocating steam plants, turbine steam plants, reciprocating and low pressure turbine plants, gas engine and turbine plants and gas engine plants. He illustrated his talk with 30 diagrams.

### ENGINEERS' CLUB, TORONTO.

The annual meeting of the Engineers' Club was held on December 10th. The election of officers resulted as follows: President, A. B. Barry; first vice-president, A. M. Canniff; second vice-president, R. G. Black. The directors, who are also chairmen of the committees, rooms, library and papers, are R. A. Baldwin and Stanislas Gagne.

At this meeting C. R. Young read a paper on Artistic Bridges for Populous Districts.

The annual dinner was held at McConkey's on Dec. 17. Mr. Randolph, of Chicago, was the speaker of the evening and gave an interesting account of the Panama canal.

On Thursday, Jan. 14, Past-President J. G. Sing will deliver his valedictory address, and on Jan. 21 R. Dawson Harling will give an illustrated lecture on "The Manchester Ship Canal."

### CANADIAN SOCIETY C.E.

The annual meeting of the society will be held in Toronto, January 28, 29 and 30. It is hoped that every member who can attend will be at this annual meeting. The co-operation of engineers in all parts of Canada will help the advancement of the profession.

### GREETINGS FROM C.A.S.E. EXECUTIVE SECRETARY.

Hearty good wishes to every member of the C.A.S.E., and to all those who have aided and assisted us during the year that has just come to a close. Further progress from a lower to a higher condition may be made if we only understand what is really needed. A good head of steam is a requisite in order to make material progress. This head of steam may be called purpose, resolution, determination, courage. If we wish to go forward we must prepare now. Put honest pride and enthusiasm under your boilers. Fire up with coal of determination.

I would like to call to your notice the fraternal side of our association. Do we ever think what fraternity means? Do we realize that it has coexisted with mankind? Studying it closely we find it fitting itself to every desirable development of the race and adapting its operations to all improvements in the conditions of life. Fraternity never casts a shadow on the home, never wounds a human heart, and is never blind to the wants of the deserving. Fraternity is the new commandment, "Do unto others as we would wish them to do unto us." Endeavor to elevate those who are not so fortunate as ourselves. During the new year we shall see many that will need our help and assistance. Let us give it to them with hearty good will. Let us prove to the world that we are anxious to build up, not to destroy, and by so doing gain the co-operation of those whose interests are identical with our own.—W. A. Crockett, Executive Secretary C.A.S.E.

### CANADIAN ELECTRICAL ASSOCIATION.

By a vote of the membership of the association Quebec, Ottawa or Niagara Falls is the choice for the next meeting place. A meeting of the managing committee will be held this month, when the matter will be definitely decided. It is expected that at the next convention interesting and valuable reports will be presented by the various committees, the personnel of which is as follows:

Committee on Theft of Current—W. J. Robertson, Montreal (Chairman); R. G. Black, Toronto, and H. O. Fisk, Peterboro.

Committee on Statistics — W. A. Bucke, Toronto (Chairman); John Murphy, Ottawa, and W. L. Adams, Niagara Falls.

Committee on Grounding of Transformer Secondaries — R. S. Kelsch, Montreal (Chairman); J. G. Glassco, Hamilton, and W. G. Chace, Winnipeg.

Committee on Meter Inspection and Testing — A. A. Dion, Ottawa (Chairman); R. S. Kelsch, Montreal; J. M. Robertson, Montreal; J. J. Wright, Toronto, and A. A. Wright, Renfrew.

W. N. Ryerson, general superintendent of the Ontario Power Company, Niagara Falls, Ont., leaves on January 2nd, 1909, to take a position with the Great Northern Power Company, Duluth, Minn.

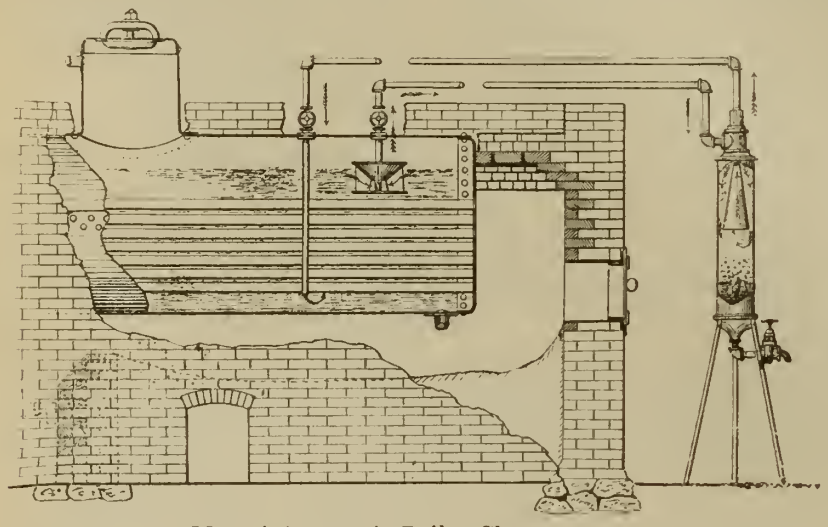
Elijah Heathcote, late inspector of mines in the Province of Alberta, has been appointed superintendent of the collieries of the Crow's Nest Pass Coal Company at Coal Creek. Mr. Heathcote was in the employ of the company some years ago at the Carbonado Colliery.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### MYERS' AUTOMATIC BOILER CLEANER.

The two essential parts of this cleaner are the skimmer, which is inside the boiler, and the precipitator, which stands on its own pedestal outside the boiler setting. The skimmer has a conical body with a bottom disc connected to



Myers' Automatic Boiler Cleaner.

it by four ribs. A tube extends below the conical body and has slotted openings in the end. The ribs are to divide or break up the scum and the sloping side of the cone is to guide foreign matter to the apertures in the tube. The disc at the bottom is to catch that scum and foreign matter which does not enter the tube.

The precipitator or settling tank, which is outside the boiler, is so arranged that when the impurities are delivered into it, they are forced to the cooler outside part and precipitated to the bottom. This sediment is blown off from time to time through a discharge valve at the bottom of the tank. The purified water is carried back, through the inside of the funnel, to the bottom of the boiler. By placing the skimmer in the upper levels of the water in the boiler (where the greater part of the impurities are found) the forced circulation carries the impurities to the settling tank, where the cooler water deposits the impurities and the purified water returns continually to the boiler.

The cleaner is manufactured by the Manchester Manufacturing Company, North Manchester, Indiana, and the Canadian trade is supplied by C. B. Turner & Co., P.O. Box 354, Toronto.

---

### LEONHARDT GAUGE GLASS PROTECTOR.

This glass is an evolution of that now in use. In addition to being a protection from broken glass if one should break, it is a protection for the glass. The shield permits free expansion and contraction of the glass tube. It also prevents any steam or liquid from escaping. The glass is of special use for fire engines, traction engines and portable engines, such as are used for hoisting and concrete work where jars and vibration are to be contended with.

To assemble the glass place it in the metal shield, and then insert the rubber gasket and metal shield. The threaded hollow nut holding the packing in place is then screwed to rest upon the metal ferrule. Fig. 1 shows a number of sizes of protectors. A is a hexagon nut which is usually made as a wing nut, this being more convenient. B is shown in section Fig. 2. It will be seen in Fig. 2 that the metal ferrule projects through the gasket into the glass tube, keeping the gasket in proper position. The protectors are made all sizes and lengths finished in gunmetal or nickel plate, but for ammonia they are made of special material.

The Canadian patents have been purchased by Harry J. Allison, M.E., of Ideal Steam Separator Co., 73 Adelaide St., Toronto, who will manufacture them in Toronto.

---

### THE "IDEAL" SMOKE CONSUMER.

The principle involved in this consumer is simply that used in an ordinary oil lamp. In operation the furnace under the boiler takes the place of the burner of the lamp and the consumer is the apparatus that supplies the air necessary to consume the smoke being analagous to the draft arrangement of the oil lamp.

In instaling this on any boiler all that is necessary is to remove the existing door and put the "Ideal" in its place. The accompanying cut shows the construction which is very simple. Above the door is shown the steam jet at 9. This is regulated by a valve just over the door on the outside of the furnace front. The steam is thrown into the furnace through a T-shaped nozzle, the top of the T having small holes drilled in it to spray the steam. very little

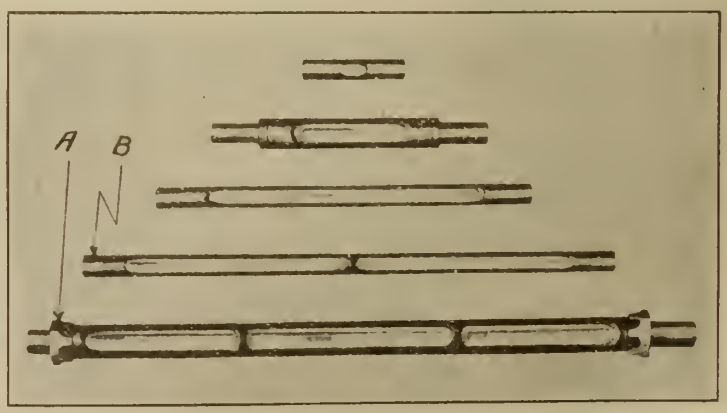



Fig. 1—Leonhardt Gauge Glass Protector.

Fig. 2.

steam is needed, just enough to add to the warm air the requisite amount of oxygen to burn the smoke.

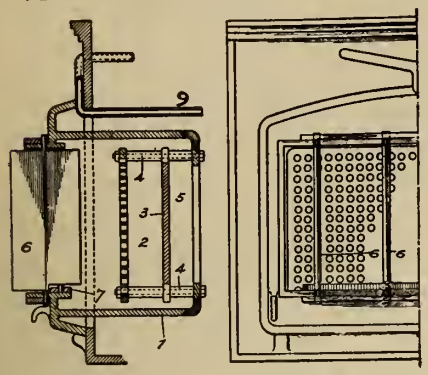


Fig. 1 Fig. 2

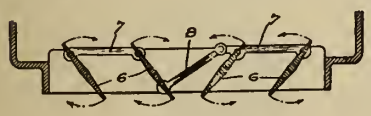


Fig. 3

Ideal Smoke Consumer.

In the door is a secondary "draft door," shown at 6, and by the sectional plan view. This door is constructed on the shutter principle, having four or more slats that allow the size of the opening to be uniformly modified. The cold air is drawn in through this opening and impinging on a series of baffle plates (3) is heated before it is mixed with the steam from the spray jet. This mixture of gases then comes in contact with the unburned smoke and gives it the requisite amount of oxygen to consume all of it.

The consumer is being placed on the market by the Ideal Smoke Consumer Company, Limited, 270 St. Catherine Street, East, Montreal.

## AMERICAN INDICATOR MOTION.

A new indicator motion has been added to the equipment of the engines of

Fig. 1—American Indicator Motion.

the American Engine Co. Fig. 1 shows the device by itself and Fig. 2 shows it in connection with the cross head. It consists of a slotted plate, through which moves an L-shaped lever pivoted at the apex of triangular plates cast with the outer plate and perpendicularly beneath it. The short arm of the lever is forked and carries a roller. Also connected with this arm is a pin which works through the outer plate and carries a helical spring which tends to maintain the long arm of the lever at one end of the slot. The device is fastened by bolts to the frame of the engine.

On the cross head is secured a cast iron cam or inclined slide set with one end about 2 inches below the other end. When the cross head moves in one direction this slide, which is in contact with the roller of the L arm, raises it in exact proportion to the piston travel against the pressure of the spring ; the reverse takes place as the cross head returns. The strength of the coiled spring is sufficient to prevent lost motion in the device, even on a high speed engine. The cam plate can be adjusted so that the travel of the upper end of the arm is that desired to turn the indicator cylinder the required distance without further reduction.

On top of the exterior plate, as may be seen in Fig. 1, is a small flat trigger or lock which engages with a slot milled in the pin working through the plate. When the pin is raised its full extent the trigger can be slipped into the slot to hold the roller out of contact with the cross head cam. Releasing the trigger instantly throws the device into service. The indicator cord may be kept attached to the lever and cards taken as often as desired.

This indicator is made by the American Engine Co., Bound Brook, N.J.

## WATTMETER FOR ALTERNATING CURRENT.

The Peterborough Meter Co. has placed on the market a type "D" meter for alternating current. Type "D" meter is designed to meet the rigid requirements of modern central station practice. It is equipped with sapphire jewels, and the bottom of the main

KILOWATT HOURS.
ONE DIVISION OF 1s DIAL-1 KW HOUR
The PETERBOROUGH METER COMPANY LIMITED
PETERBOROUGH, ONTARIO, CANADA
TYPE D-SINGLE PHASE CYCLES
AMPERES VOLTS No
WATT HOURS PER REV. OF DISC

Peterborough Intergrating Wattmeter.

shaft carrying the disc is coneaved, with a highly polished hardened steel ball inserted. It possesses a very high torque insuring accuracy on low loads, and the speed of the meter can be easily regulated by means of a micrometer or screw adjustment provided. It is claimed that the meter records under a load of less than one per cent. of its rated capacity, and registers within two per cent, of rated capacity to 50 per cent. overload continuously without injury.

John Forman, of 218 Craig Street West, Montreal, is controlling the sale in Canada of the Peterborough Integrating Wattmeter for alternating current.

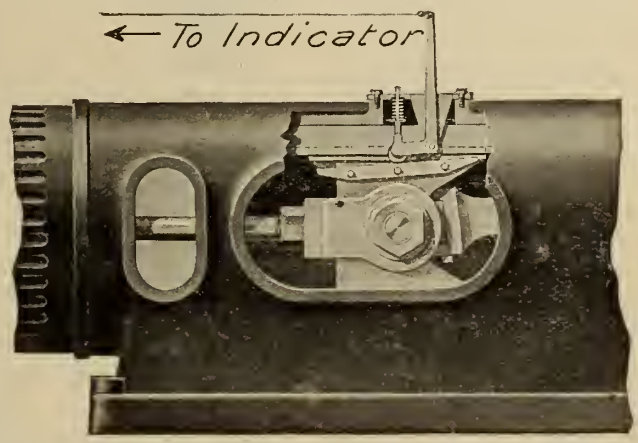



Fig. 2—American Indicator Motion.

### WING'S TURBINE BLOWER.

It is a combination of two well-known machines, Wing's Disc Fan or Blower and a simple Turbine Engine. The engine consists of a series of buckets or vanes fastened to the outer ends of the fans or blower blades to receive the impulse of steam, and three or more nozzles from which the steam impinges on the turbine buckets that are especially

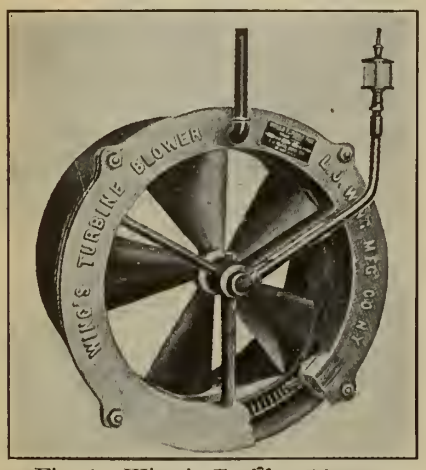



Fig. 1—Wing's Turbine Blower.

designed to get a high value of steam expansion. For forced draft the small amount of steam that drives the blower passes in under the grate with the air, thoroughly mixed, and gives a good combustion.

Each boiler has its individual blower, which is placed in side wall of water tube boilers and in the rear wall of water tube boilers as shown in Fig. 2. Wing's Turbine Fan is used for ventilation, drying, removing heat, steam, vapors, dust, etc., also particularly available for cooling towers, humidifying the air in cotton, silk or other mills, etc. For these purposes they are made in large sizes as 30, 36, 42, 48, 60 inches. For ventilating of mines, tunnels, factories, theatres, etc., the fans can be run with compressed air acting on the buckets in place of steam, and provide an ideal

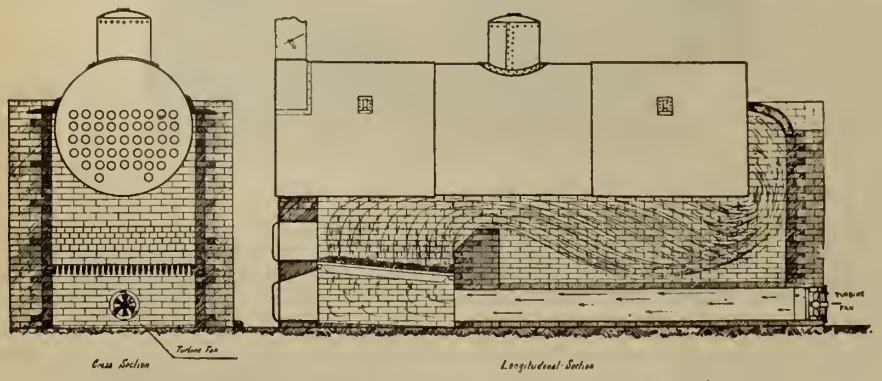


Fig. 2—Wing's Blower Applied to Return Tubular Boiler.

system of supplying cool, fresh, pure air.

These fans are being manufactured in Canada by the Laurie Engine & Machine Co., Montreal.

### NEW TYPE OF PIPE FITTINGS.

The union-cinch fittings are made in sizes corresponding to standard iron pipe up to one inch, and are especially designed for use in connection with the oil pumps and oilers manufactured by the Sight Feed Oil Pump Co.

It is possible to use ordinary rough pipe with these fittings, if care is exercised in filing the ends of the pipes round and smooth. This tubing has 16 gauge wall on the ¾-in and 1-in. size, and 18 gauge wall in smaller sizes, and has, therefore, a large carrying capacity.

A hack saw and monkey wrench are all the tools that are required, except where some very fancy work has to be done, in which case a bending rig of some sort is very convenient. Each fit-

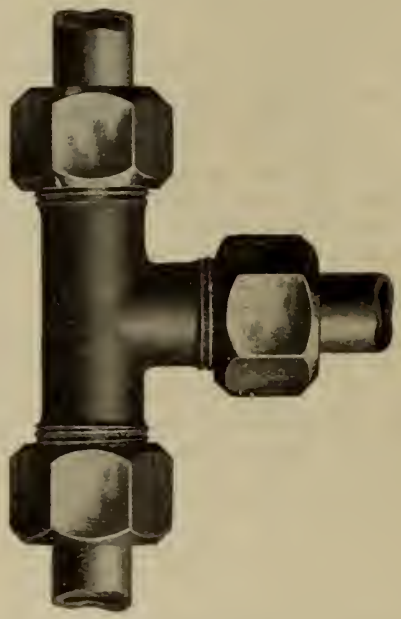


Fig. 1—New Type of Pipe Fittings.

ting is a union, and the piping may be taken down at any point where a fitting is inserted. The joint is made by screwing down the outside nut, which presses a thin, tapered shell into the annular cavity around the pipe, between it and the fitting, as shown on sectional cut. These nuts may be pulled up good and hard and the soft cone shell will make a tight joint around the tubing, which is good for 1,000 lbs. pressure per inch.

This type of joint may be taken down and made up again any number of times. It may be used for piping up oil pumps, gravity oiling devices, gauges, drop pipes, etc., and especially in such work around ammonia handling machinery, where this steel tubing and fittings (made of steel) are especially valuable

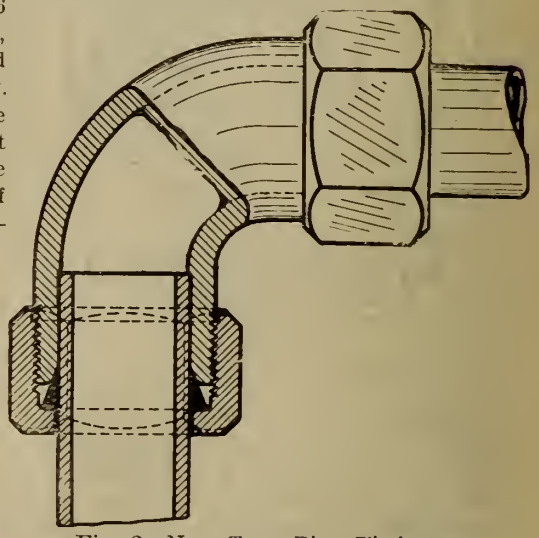


Fig. 2—New Type Pipe Fittings.

because of the readiness with which they may be made up perfectly tight against the escape of ammonia gas.

These union-cinch fittings are manufactured by Sight Feed Oil Pump Co., Milwaukee, Wis.

### FREE TO ALL ENGINEERS.

The Penberthy Injector Co., Windsor, Ont., have just gotten out a handsome watch fob and will mail one free of charge to any engineer mailing in his name and address to them and enclosing 15 cents in stamps or coin to cover postage and packing. The number to be given out is limited.

### A NEW ENGINEERING COURSE.

At McGill University last week was inaugurated a new course in connection with the engineering courses already established. This course takes up the business end of the engineering profession or the business of engineering. R. A. Ross, of Ross & Holgate, Consulting Engineers, will be in charge of this new branch of study at the university, which should prove to be very interesting and instructive.

In comparison, 57.25 pounds of coal or 63 pounds of coke is equal to about 1,000 cubic feet of natural gas. Producer gas made by the partial combustion of coal to carbonic oxide is a lean gas composed of about 25 per cent. CO and about 60 per cent. of nitrogen. The calorific value is about 150 B.t.u. per cubic foot.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Municipal Enterprises.

Ladysmith, B.C., will have a sewerage system to cost $50,000.

The council of Revelstoke will spend $10,000 to complete the civic power and light plant.

The town of Hawkesbury, Ont., will spend $30,000 on a waterworks and sewage system.

The by-law to issue $40,000 sewerage debentures at St. Thomas has been carried. W. R. Doherty, city clerk.

The by-law to issue $12,000 for electric light purposes for Barrie, Ont., was carried on Jan. 4 by a large majority. C. Donnell, town clerk.

Three by-laws at Waterloo, Ont., $15,000 for a ward school; $5,000 for road improvements, and $3,000 for an isolation hospital, were carried. A. McBride, town clerk.

Vernon, B.C., council have decided to spend $25,000 on the B. X. Creek water supply. Reports were received from John Galt, C.E., and Messrs. Meredith & Tracy, estimating the Long Lake scheme to cost $96,000.

The following by-laws have been carried by Port Arthur: To issue $28,500 electric railway debentures: $6,712 street grading debentures; $25,000 for further development of Current River power. J. McTeigue, city clerk.

Owing to the scarcity of water, Fort William has asked the Ontario Government to give the Kaministiquia Power Co., which has a concession at Kakabeka Falls, permission to conserve the waters of several streams running into the Kaministiquia river.

The citizens of Saskatoon have voted $11,500 for the extension of the waterworks plant; $13,500 for firehall site and equipment; $30,000 for the extension of the electric light plant; $38,861 for the extension of the sewer system, and $9,300 for the extension of the water service.

The Vernon, B.C., city council have decided to spend $25,000 on the B. X. Creek water supply. Reports were received from John Galt, C. E., and Meredith & Tracy. The reports estimated the Long Lake scheme would cost $96,000, but this scheme, besides supplying water for $5,000, would furnish 300 to 500 horse-power.

Sealed tenders will be received by the chairman of the Board of Control, Winnipeg, for supply of 50 luminous or magnetite arc lamps with necessary station regulating apparatus for controlling same, at the office of the undersigned up to 11 a.m., Wednesday, January 20, 1909. M. Petterson, secretary.

Under municipal ownership the charges for electric light in Orillia have been reduced as follows: For stores, from 28c to 18c per lamp a month; for houses, from 20c to 18c a month. This is for 24-hour power every day. Last year there was a profit of $10,000 after meeting all charges, which was applied to the reduction of taxes. Even with the reduced cost of light to consumers this year, it is expected that there will be the same surplus, as 1,000 new lights have been installed in the past three months. Under private ownership the cost of lighting was about 35c per lamp.

Smith, Kerry & Chace, engineers, Confederation Life Building, Toronto, Ont., state that Lethbridge, Alta., will expend about $100,000 for a steam power plant to be built on the Belly River at Lethbridge. Lethbridge owns a plant which it purchased from a local company. The new station will have mechanical stoking, fuel economizers, surface condensers, and will include 450 kw. old machinery, 500 kw. new; a 2,000,000-gallons steam or electric pump and space for 500 kw. additional electrical machinery. The plans and specifications are ready. The plant will supply light and power to the town.

## Electrical Notes.

The Western Electric Company has opened an office in Fort William.

The Electric Light Co., Okotoks, Alta., are erecting a building and instaling machinery at a cost of $10,000.

Archie L. Simmie, of London, is engaged in instaling a 500 horse-power engine in the plant of the McKinley-Darragh-Savage Mining Co., Cobalt.

The Hydro-Electric Power Commission's agreement with Toronto promises to deliver power to Toronto by December 19, 1909, and R. L. Atkin, engineer in charge of the city's distribution plant, says the transmission line should be completed by that time.

A deputation from Belleville recently waited upon the Ontario Government in regard to improving the Moira river's natural reservoirs in order to provide electric power for Belleville, Tweed, Madoc and other towns. Concrete dams at various lakes may be built, at a cost of $35,000, to preserve the natural flow.

The electric locomotive, which was fitted up at the Canadian General Electric Works, Peterboro, with motors, etc., has left the shop and has been taken to Shawinigan Falls, Quebec. It has two trolleys when in operation, and there are four motors that provide power. Two men are required to operate it, and it travels at a speed estimated at 30 miles per hour with 30 freight cars as a load.

It is expected that Peterboro will shortly approach the Hydro-Electric Power Commission with regard to power. It is proposed to obtain this if possible from sources about twenty miles north of the city, and have practically the same plan worked out as at Ottawa. Failing in this, however, the commission may be asked to bring Niagara power to Peterboro. It is thought that perhaps 8,000 horse-power may be used annually.

The Ontario Power Co., Niagara Falls, contemplates the construction of another pipe line from the gate house at the Dufferin Islands to the power station at the bottom of the bank, a distance of about three-fourths of a mile. The line will cost about $700,000. This additional pipe line is made necessary because of the contract which the Ontario Power Company has executed with the Hydro-Electric Commission to supply the electric current to the Government transmission line. For some time there has been building a considerable addition to the power house below the bank to accommodate other units. The work of instaling the units and of laying the pipe line will be completed in time for the execution of the Government contract. Under the terms of its charter, the Ontario Power Company may develop 180,000 horse-power. At the present time the company is developing 75,000 horse-power, and the contemplated work will increase the output of the plant to 140,000 horse-power. The company has authority to export to the United States 60,000 horse-power, while at the present time but 30,000 horse-power is exported. The plant now has installed six units, three of 10,000 horse-power. The others, 12,500 units, have proved so satisfactory that the company is changing over the 10,000 units now. The new units which will be installed to develop the additional "head" will all be of the larger class.

## Trade Notes.

The H. W. Johns-Manville Co., Toronto, held their annual meeting of travelers in December. George A. Schmidt, Canadian manager, gave the travelers and employes of his company a banquet at the King Edward. The management consider the business outlook for 1909 to be very bright.

The Robb Engineering Co., Ltd., of Amherst, N.S., have recently received the following orders from Cobalt, Ont.: 1 30 h.p. Robb-Armstrong vertical engine. For the Colonial Mining Co., 1 75 h.p. Robb-Armstrong vertical engine. For the Temiskaming Mining Co., 2 100 h.p. Robb-Mumford water tube boilers.

The Smart-Turner Machine Co., Ltd., Hamilton, have supplied the Robt. Simpson Co., Toronto, with a pair of their duplex outside-packed plunger pumps, with pot valves. Other companies supplied are, I.C.R., Montreal; Bechtels, Ltd., Waterloo, and G.T.R., Bracebridge. They are instaling a 10-ton electric crane in the I.C.R. shops, River du Loup, Que.

Wm. B. Mason, president, and W. A. Macleod, treasurer, of Mason Regulator Co., Boston, Mass., were in Montreal recently, establishing an eastern Canadian agency for their reducing valves and regulating devices. They appointed Peiler & McKenzie, 17 St. John St. Montreal, eastern Canadian agents. Among the lines handled are reducing valves, damper regulators, pump and elevator pressure regulators, steam engines and pumps.

## Gas Items.

Seattle capitalists may establish a gas plant in North Vancouver.

New Westminster will have a new gas plant. It will cost about $80,000.

Waterford, Ont., is forming a syndicate, and will bore for natural gas.

The Provincial National Gas and Fuel Co. has paid $10,000 for a lease of 5,000 acres of marsh land south of Welland, and will prospect for oil and gas. They are preparing to drill a well to a depth of 3,300 feet.

The new building for the Bridgewater Gas Engine Company, at Bridgewater, has just been completed and the company is now instaling the machinery. The company is starting the operations at once and the first engine will be turned out about the beginning of the year.

A saving of $7,000 will be made this year by Toronto operating the civic gas lighting system. Prior to 1907 the lighting of the streets by gas lamps was let by tender. Since then, under municipal control, the lamplighters have received higher wages and the lights have given better service.

St. Catharines Board of Trade unanimously passed a resolution in favor of the conservation of Canada's natural gas supply, and asking the Governor-in-Council to pass an order prohibiting its exportation to the United States. An effort will be made to enlist co-operation of other municipalities interested in the question, because of a shortage.

The question of the gas producer was discussed by Kamloops council, when Frederick Nicholls, president of the Canada Foundry Co., Ltd., was present. The trouble was that the producer was not adapted to Bankhead coal, and in speaking of the matter, Mr. Nicholls stated that he would not shirk any responsibility. A sample of the fuel had been analyzed, but in some way the company had failed to hit off the exact producer required for that kind of coal. This the company would do, however, even if it cost more than the original figure named in the contract. It would take time and it would be neeessary to supply a new producer especially designed to use coal from Bankhead, the cost being about $2,500. This extra expense would be borne by the company, which, in addition, would leave the city in possession of the old producer. Satisfaction was expressed by the city solicitor at the attitude adopted by the company.

---

## Winnipeg Power Scheme.

The Winnipeg Board of Control have awarded contracts for general power works at Point du Bois, to John Gunn & Sons at $[illegible]; for aluminum cable to the Northern Aluminum Co. at $148,050, and for steel towers to Manitoba Iron Works at $3.90 per 100 pounds, estimated cost being $57,550. Tenders for the construction of a transmission line were not considered, and will be taken up later.

---

## General Electric Co.'s New Offices.

The Canadian General Electric Co. and Canada Foundry Co. have moved into their handsome new offices situated on the northwest corner of King and Simcoe Streets, Toronto. This five-storey structure was designed by Architects Darling & Pearson, Toronto. It is well equipped for the economic handling of the business of these two companies. The steam heating plant in the basement was installed by the Canada Foundry Co. and the chimney by Alphons Custodis, New York, represented in Canada by Eadie-Douglas Co., Montreal. The electric wiring was done by the Canadian General Electric, and the elevators were built by Otis-Fensom Co.

---

## Peterborough Lubricator Mfg. Co.

The Peterborough Lubricator Mfg. Co., who recently opened up a sales and demonstration office at 127 Bay Street, have made several instalations of Philadelphia grease cups. The Toronto office is in charge of Alfred Cornwall and

Fred T. Daville is traveling salesman. Installations have been made at T. Eaton's, City Hall, Berg Machinery Mfg. Co., Stair Building, Toronto; Canadian General Electric, Peterborough Machinery Co., and Quaker Oats Co., Peterborough. Many inquiries have also been received and demonstrations are being given at the Toronto office.

The Peterborough plant is now in operation, in charge of W. C. Pennington, superintendent. Special machinery has been installed with a capacity of 10,000 cups per month. These grease cups may be used for elevators, machine tools, wood-working tools, engines, etc. M. W. Boerema will leave for England in a few weeks to introduce these cups there; also to France, Germany and Belgium, he having purchased the patent rights for those countries.

## Toronto High Pressure Pumps.

Following the acceptance of the high pressure system in Toronto the insurance companies have lowered their rates and this means a saving of $290,000 per year for the business men of Toronto. There are two Westinghouse-Parsons turbines in the John St. pumping station attached to two two-stage twelve-inch turbine pumps. The turbines take steam at 150 lbs. pressure and can develop 150 lbs. pressure on the water mains in 15 seconds.

The pumps can pass 10,000,000 gallons of water in 24 hours at a pressure of 300 lbs. per square inch at the pump, through the 20-inch high pressure fire fighting water mains. With 150 lbs. steam pressure the turbines work at 1,500 r.p.m.

The present system costs the City of Toronto $36,625 a year for 40 years. An additional $250,000 will complete the system and bring the cost per year for 40 years up to $45,900.

The underwriters have asked for three pumps with a maximum capacity of 6,000 gallons per minute. It is the intention to instal two electrically driven pumps, one having a capacity of 5,000,000 gallons per day, and the other 2,500,000 per day.

## The Hydro-Electric Power Situation.

The following towns have carried power by-laws: Amherstburg, Bothwell, Comber, Dundas, Elmira, Essex, Glencoe, Leamington, Norwich, Port Stanley, Ridgetown, Simcoe, Sandwich, Stratford, Tilbury, Tillsonburg and West Lorne.

In the following towns the by-law was defeated: Brantford, Kingsville, Thamesville. In Brantford the power by-law was for $20,000, to supplement the $55,000 already voted for a plant for the Hydro-Electric power. The defeat of this by-law does not mean that Brantford is out of the power union. Fifty-five thousand dollars may be spent if the council so decides. The vote, however, is interpreted locally as an indication that the ratepayers are favorable to accepting the offer of the Western Counties Power Co. now operating in Brantford, and thus abandoning the Hydro-Electric project.

The Hydro-Electric Commission quote prices of $36.25 per h.p. per year for Chathnm figured on 600 h.p., with an advance of $3.50 to $4.50 per h.p. on this price to manufacturers. The Colonial Engineering Co., Montreal, have offered to supply power to Chatham users at $20.15 per h.p. per annum. The supply of natural gas in Chatham being of a good quality and abundant in quantity makes possible this low price for power.

# Power Supply Markets

## Toronto Market.

There is a brighter outlook among business men, and general confidence is shown in the prospect for trade during the coming season. In some branches, the past year has witnessed a falling off and the volume of business was not as great as that of the previous year. To-day there are tangible evidences of activity. Producers are now placing orders and many new plants are planned for Toronto and Western Ontario which will require power equipment and supplies. Reports from the manufacturing plants through Western Ontario are most encouraging. Hands are being taken on and the volume of business has increased to such an extent in some plants that additions are being planned.

The passing of the by-laws by many towns of Western Ontario to take power from the Hydro-Electric Commission will mean the construction of more lines and consequently increase the demand for electrical machinery.

The H. W. Johns-Manville Co., Toronto, manufacturers of steam pipe and electrical insulating material, recently held their annual meeting of travelers and they were all optimistic about Canadian business in 1909.

The annual meeting of the Canadian Westinghouse salesmen was held in Hamilton in January. About 30 representatives, scattered from Halifax to Vancouver, were present, and all gave good reports of prospects for 1909.

BOILER TUBES—Orders have increased and there is now a steady demand. The following prices are quoted per 100 feet: 2-in., $8.50; 2½-in., $10.50; 3-in., $12.50; 3½-in., $15, and 4-in., $18.

LEAD WOOL—$10.50 per 100 lbs., $200 per ton.

OILS—The demand for lubricating oils is increasing as factories are increasing the hours of working their plants. Prices have not changed recently and the Queen City is working on the list of June, 1907.

## Winnipeg Market.

A great amount of supplies will be needed for the big power development scheme which the city is undertaking, and prospects for 1909 are bright. The markets generally are fairly steady.

LUBRICATING OILS—600 W. cylinders, 80c; Maple Leaf cylinder, $1 per gal.; 700 A. cylinder, 75c; Sterling cylinder, 55c; 600 A. cylinder, 50c; Capital cylinder, 59c and 54c; Solar red engine, 32c; Atlantic red engine, 29c; heavy castor, 29c; medium castor, 28c; Ruddy harvester, 30c; standard gas engine oil, 36c; Renown engine oil, 38c.

## Montreal Market.

OILS—Lubricating oils of the petroleum class are perfectly steady. The demand is not excessive by any manner or means, but shows increase, due no doubt to the recommencement of those plants which have recently been idle. The current prices, depending upon quality, are as follows: Cylinder oils (imp. gal.), 60c to 80c; engine oils, 30c to 60c; machine and dynamo oils, 30c to 45c; shafting oils, 25c to 40c; lubricating greases (16) 8c to 12c.

BOILER TUBES—The movement in this line has begun to show improvement and the increase of business is marked by the fact that instead of the 15 or 20-day deliveries made by the mills last fall, 60 to 90 days are needed to fill orders. There has been a fairly steady call for small lots, these going usually to boiler makers doing local business in small places. The prices are fairly steady as follows: 2-in. tubes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

BOILER ACCESSORIES—The market has been extremely quiet owing to retrenchments on the part of the manufacturers, due to the general feeling of depression and slowness of sales. General conditions have improved markedly in the last three months and many improvements have been begun and carried out that were originally planned in the summer and autumn of 1907. Prospects have brightened very materially and while there are no boom conditions, there appears to be a general feeling of confidence among manufacturers. The demand for steam specialties has about reached normal conditions and business should be particularly good during this year. This normal demand will no doubt be considerably augmented on account of the "starving" of power plants, which has taken place during the past year. One house says: "We look for a steady, healthy measure of improvement, nothing "boomish" nor startling. For the past year purchases have been almost wholly confined to what was absolutely necessary. Stocks are, therefore, low and must soon be replenished."

## CATALOGUES.

The publishers of these catalogues will be pleased to send these catalogues to anyone sending his name and address and mentioning The Power House.

BLOTTER—Christmas and New Years blotter from the Electrical Maintenance & Repairs Co., 162 Adelaide St. West, Toronto.

TRANSMISSION MACHINERY—Catalogue of hangers, shafting, pulleys and friction clutches from the Dodge Mfg. Co., Toronto.

STEAM SEPARATOR—From Ideal Steam Separator Co., 73 Adelaide St. E., Toronto, describing their Ideal steam separator for drying steam.

REDUCING DEVICE—Description and illustration of Nugent reducing motion and oiling device from Wm. W. Nugent & Co., 18-30 West Randolph St., Chicago.

ELECTRICAL APPARATUS—From Crocker-Wheeler Co., Ampere, N.J., Bulletin 106 of D. C. switchboard panels and 107 of D. C. lighting and power generators.

CENTRIFUGAL FANS—Bulletin No. 158 from B. F. Sturtevant Co., Hyde Park, Mass., describes their fans, blowers, economizers, heaters, dust collectors, high pressure blowers and exhausters.

STEAM TURBINES—Leaflet No. 10 from the D'Olier Engineering Co., 17 Battery St., New York, illustrates steam turbines. Bulletin T9 describes and illustrates D'Olier horizontal centrifugal pumps.

SURFACE CONDENSER—Bulletin 103 from Wheeler Condenser and Engineering Co., Carteret, N.J., describes and illustrates Wheeler-Edwards air pumps. The pump is fully described and illustrated.

GENERATOR SETS—From Crocker-Wheeler, Ampere, N.Y., bulletin No. 108 describing engine types A. C. generators for central stations and industrial plants and a number of instalations are shown, comprising municipal plants, textile mill plants, etc.

EXHAUST HEAD—19-page catalogue on coated paper from the Ohio Blower Co., Cleveland, describes the helico-centrifugal apparatus, including exhaust heads, steam separators. Details of oil separators are given and several pages of handy information.

INDUCTION MOTORS—Circular 1258 from Canadian Westinghouse Co., Hamilton, describing type CCL polyphase induction motors, squirrel-cage rotors, constant speed. The motors are described in detail with illustrations. Their application to machine tools, pumps, etc., is also illustrated.

RE-ACTIONS—The fourth quarterly issue for 1908 contains several interesting articles on the use of thermit for welding pipes, shafts, locomotive frames, etc. A history of the business is also given. A copy may he had by writing the Goldschmidt Thermit Co., 103 Richmond St. W., Toronto.

WESTINGHOUSE DIARY—The Canadian Westinghouse Co., Hamilton, are supplying their customers with a very useful diary for 1909 with leather cover. Calendars for 1909 and 1910 are included together with three maps of Canada and a mass of information about motors, lamps, power to drive machine tools, turbines, etc.

BUFFALO FAN SYSTEM—143-page catalogue from Buffalo Forge Co., Buffalo. Part I. deals with heating and ventilating public buildings; Part II., heating and ventilating industrial buildings; Part III, Buffalo heating and ventilating apparatus; Part IV., data on heating and ventilating. It contains much valuable information on these subjects.

AIR PUMP—Catalogue from the Wheeler Condenser & Engineering Co., Carteret, N.J. The peculiar action of the Wheeler-Edwards pump in handling both air and water is explained. Various types of Wheeler-Edwards pumps are shown, also a number of large steam turbine instalations in which these pumps are used. The latter half of the book is made up of discussions of the principles of air pumps, tables of mixed vapors, a complete and original table of saturated water vapor from 60 to 180 degrees Fahr., etc. The final section gives practical instructions for the handling of pumps of this character.


# Engineers' Examinations

Every engineer who is not in possession of an Ontario Engineer's Certificate must pass an examination. We will prepare you for that examination personally or by correspondence, and the fee once paid is available until the examination is passed.

Also Marine Courses for the Dominion Government Examinations (all grades).

Write us for particulars, or call at

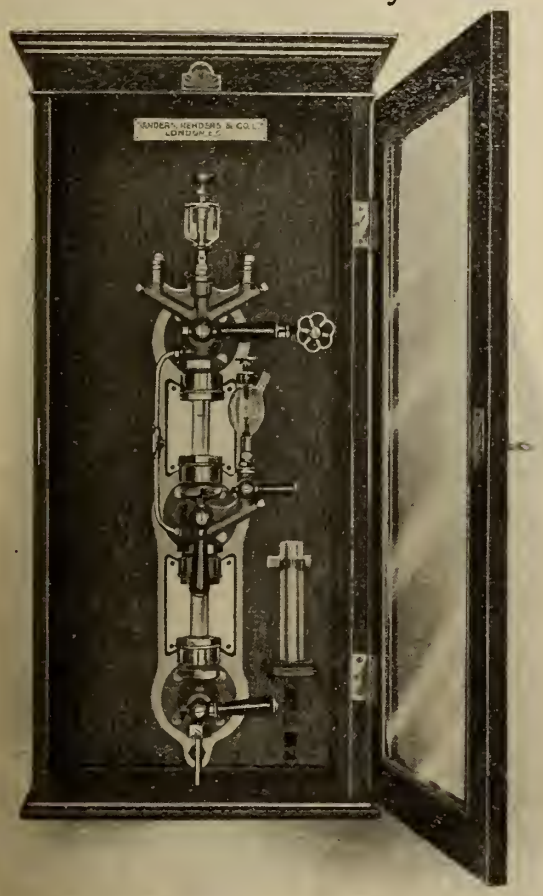
**The DOMINION ENGINEERING ACADEMY**

Room 23, CURRY BUILDING

Cor. SPADINA and COLLEGE, - TORONTO

# Instruments that Positively SAVE MONEY

for every owner of a Steam Power Plant.



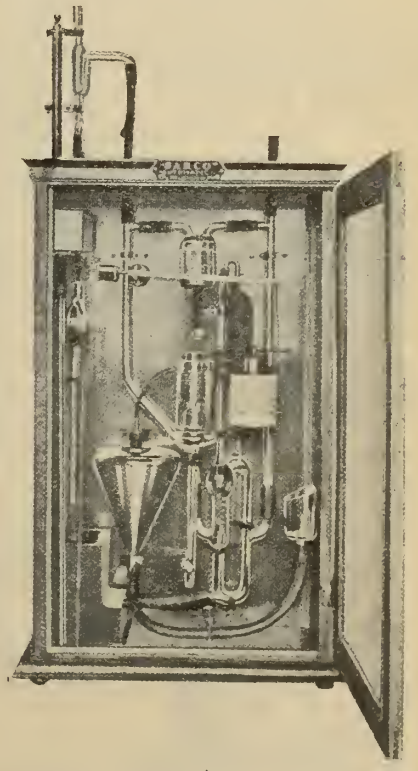
## Boiler Scale Prevention

is one of the toughest problems you have to face as the owner of a steam boiler. It is well known that Soda is the best preventative of Boiler Scale; the difficulty has been to know the right quantity to apply to the feed water. Thus more or less elaborate water softening plants often fail to prevent scale formation. But the problem has now been satisfactorily and inexpensively solved by the invention of the

## "SARCO"

## Feed-water Analyser

a small and simple instrument which analyses your feed water from day to day, infallibly indicating the exact amount of soda necessary to absolutely prevent the formation of scale in your boilers. We positively guarantee SARCO FEED-WATER ANALYSER to give an absolutely correct analysis of any feed-water to which it is applied.



## You Lose Money on Incomplete Fuel Combustion;

and if you had an instrument that would automatically tell you every hour just exactly how near perfectly your fuel was burning, you would save a lot of money; because "fore-warned is fore-armed." It would enable you to make provision to get a hundred cent's worth of combustion for every dollar's worth of fuel shovelled into your boiler furnace. There is such an instrument!—the

## "SARCO" Combustion Recorder

It automatically analyses the exit gases created by fuel combustion, and indicates upon a chart, in plain view all the time, the exact percentage of carbon dioxide which that gas contains. 20% Carbon Dioxide (C O 2) indicates practically complete combustion. Consequently the farther your furnace is from effecting complete combustion the more it is up to you to STOP THE WASTE.

Full particulars and prices sent immediately upon request.

# Canadian Instrument and Testing Co.

Montreal - - Canada

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

American Industrial Pub. Co ..... 43
American School of Correspondence ..... 41
Audel & Co., Theo..... 7

**B**

Beaubien, De Gaspe ..... 48
Borden-Canadian Co ..... inside front cover

**C**

Canada Chemical Mfg. Co ..... 7
Canada Metal Co ..... 45
Canadian Association of Stationary Engineers..... 41
Canadian Instrument and Testing Co ..... 37
Canadian Steam Boiler Equipment Co ..... 4

**D**

Death & Watson ..... 48
De Clercy, Jules, C.E ..... 47, 48
Dodge Mfg. Co ..... 44
Dominion Eng. Academy ..... 36

**E**

Electrical Maintenance & Repair Co .. inside back cover

**F**

Farmer, John T ..... 48
Francis, Walter J..... 48

**G**

Garde, John, & Co ..... 47
Gas & Electric Power Co..... 2
Goldie & McCulloch Co..... 8
Goold, Shapley & Muir ..... 3

**H**

Hercules Float Works ..... 47

**I**

Ideal Smoke Consumer Co..... 38

**J**

Jenckes Machine Co..... 3
Jones Underfeed Stoker Co..... 1

**K**

Kerr Engine Co ..... 39
Kilmer, Pullen & Burnham..... 39

**Mc**

McLaren, D. K., Ltd..... 5

**M**

Morrison Brass Mfg. Co., Ltd., Jas ... outside back cover

**P**

Packard Electric Co., Ltd..... 48
Parke, Roderick J..... 48
Peiler & MacKenzie ..... 6
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H W ..... 6
Peterboro Lubricator & Mfg. Co..... 4

**R**

Robb Engineering Co ..... 2
Robertson, Jas. L., & Sons ..... 38
Robertson, J. M..... 48

**S**

Sadler & Haworth..... 3
Sammett, M. A..... 48
Shanly, J. M ..... 48
Sheldons Limited ..... 7
Sight Feed Oil Pump Co ..... 1
Standard Engineering Co ..... 3
Stephenson Mfg. Co ..... 47
Schuchardt & Schutte ..... 47

**T**

Toronto Plate Glass Importing Co..... 47

**W**

Waterous Engine Works Co ..... 1
Wilson, J. C., & Co ..... 47


# Condensed Advertising

## TO INVESTORS.

ONE OF THE PROGRESSIVE Western Contracting Companies last year paid 40% casb from its manufacturing profits. Tbe company is now extending to meet the heavy demand on tbe coast and now offers a small block of its stock at par. For full particulars write Box 1 POWER HOUSE, Toronto.

## DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Macbine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. Tbe "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

## MISCELLANEOUS.

BETTER, CHEAPER, SAFER LIGHTING.—The Pitner System of Gasoline Lighting is the best system yet produced for lighting a store, hotel or public building. In cities and towns Pitner Systems are used because of tbe superior quality and quantity of light obtained for small cost. They are just as successful in any village or country place. A small outlay secures a complete and independent Pitner lighting plant. Free illustrated booklet and full particulars on request. The Pitner Lighting Co., Limited, Toronto, Canada

THE RELIABLE LIGHT will light your store 100% better than gas, electricity or acetylene. 600 candle power light costs 1 cent per hour to operate. Thousands in use. A safe, reliable, pure white light of intense brilliancy. Write for booklet M. The Rice-Knight Mfg. Co., Limited, 40 Lombard Street, Toronto.

## MACHINERY WANTED.

SECOND-HAND ENGINE, from 65 to 70 horse-power. State price and condition same is in. Krug Bros. & Co., Chesley, Ontario.

GASOLINE ENGINE, 6 to 9 h.p. and dynamo, 75 to 150 lights; both in perfect condition. Box 4, Delhi, Ont.


# WATER POWER

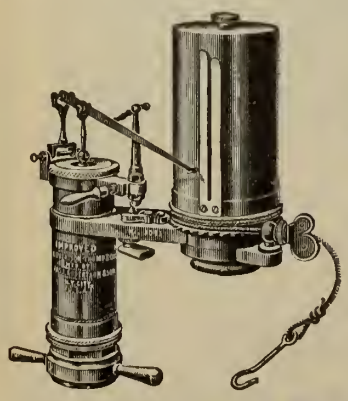
**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**
**TECHNICAL BOOK DEPARTMENT**
**10 Front St East - - Toronto**



**POWER PROFIT is MONEY EARNED**

Every Engine will do more work without extra cost when tuned up with a

**ROBERTSON-THOMPSON INDICATOR**

Up-to-date in construction—sold at a moderate price and on easy terms if desired.

**Jas. L. Robertson & Sons**
**38 Warren St., New York**

# BURN YOUR SMOKE

## and Save Your Coal

This is easily and surely done by

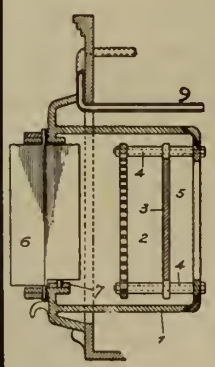


*Fig. 1*

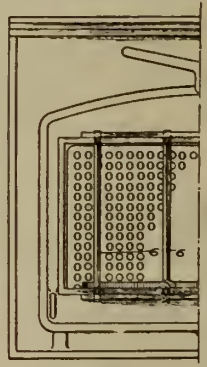


*Fig. 2*

*Fig. 3*

**The "IDEAL" Consumer**

Quickly and easily attached to OLD or new boilers. The results will surprise you.

*Send for prices and particulars.*

**The IDEAL SMOKE CONSUMER CO., Limited**
**270 St. Catherine St. E., MONTREAL**

# The General Electric Co. of Sweden

400-H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

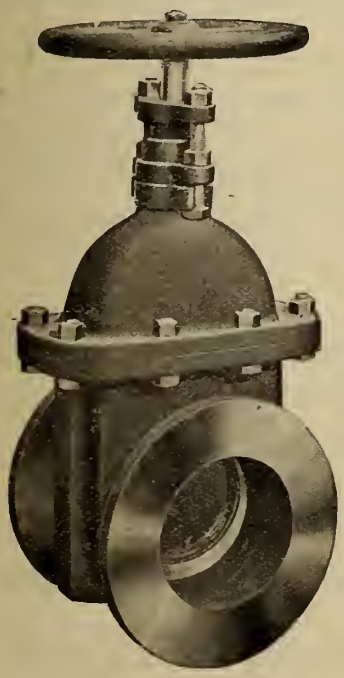
## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO



# KERR GATE VALVES

***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

## The Kerr Engine Company, Limited

***Valve Manufacturers***

**Walkerville, - Ontario**

# THE POWER HOUSE BUYERS' DIRECTORY

To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.

To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.

To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.

### Air Chambers.
Hercules Float Works, Springfield, Mass.

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Dressings.
Stephenson Mfg. Co. Albany, N.Y.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
Canadian Fairbanks Co., Montreal.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

### Boiler Cleaner.
Canada Chemical Mfg. Co., London.

### Boiler Feed Regulators.
Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boiler Mountings.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boilers.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Castings, Brass.
Hercules Float Works, Springfield, Mass.

### Combustion Recorder.
Canadian Instrument and Testing Co., Montreal.

### Condensers.
Goldie & McCulloch Co., Galt.

### Consulting Engineers.
Bain & Mitchell, Montreal
De Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Saunnett, Montreal.
J. M. Shanly, Montreal.

### Coppersmiths.
Hercules Float Works, Springfield, Mass.

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Damper Regulators.
Peiler & MacKenzie, Montreal

### Dynamos.
Electrical Maintenance & Repair Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Electrical Repairs.
Electrical Maintenance & Repair Co., Toronto.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Automatic.
H. W. Petrie, Toronto.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

### Engines, Gas and Gasoline.
Gas & Electric Power Co., Toronto.
J. DeClercy, C.E., Montreal.

### Engines, High Speed, Steam.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Simple and Compound.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Vertical.
H. W. Petrie, Toronto.

### Exhaust Heads.
Standard Engineering Co., Toronto.

### Feed Water Analyser.
Canadian Instrument and Testing Co., Montreal.

### Feed Water Heaters
Goulds Pump Co., Montreal.
Peiler & MacKenzie, Montreal

### Floats, Seamless, Copper.
Hercules Float Works, Springfield, Mass

### Gas Producer Plants.
Bain & Mitchell, Montreal
Gas & Electric Power Co., Toronto.

### Gauges, Pressure, Vacuum and Recording.
Peiler & MacKenzie, Montreal

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Grease Cups.
Peterboro Lubricator Mfg. Co., Peterboro

### Hangers.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Heaters.
Goldie & McCulloch Co., Galt.

### Heating and Ventilating Apparatus.
Sheldons Limited, Galt.

### Indicators, Steam Engine.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Mechanical Stokers.
Jones Underfeed Stoker Co., Montreal.

### Meters, Water and Electric.
Peiler & MacKenzie, Montreal

### Mill Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Motors.
Electrical Maintenance and Repair Co., Toronto.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Pipe Threading Tools.
Borden-Canadian Co., Toronto.

### Planimeters.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York

### Plate Work.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooko, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford.

### Power Transmission Machinery.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
Waterous Engine Works Co., Brantford

### Pump Governors.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt.

### Safety valves.
Peiler & MacKenzie, Montreal

### Shafting.
Canadian Fairbanks Co., Montreal.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Union Drawn Steel Co., Hamilton.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Special Machinery.
Electrical Maintenance and Repair Co., Toronto.

### Steam and Oil Separators.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Steam Pumps.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

### Steam Specialties.
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Sheldons Limited, Galt.
Standard Engineering Co., Toronto

### Steam Traps.
Peiler & MacKenzie, Montreal
Sheldons Limited, Galt.

### Stocks and Dies.
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Switchboards, Light and Power.
Electrical Maintenance and Repair Co., Toronto.
Gas & Electric Power Co., Toronto.

### Tanks, Oil.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Sight Feed Oil Pump Co., Milwaukee, Wis
Waterous Engine Works Co., Brantford

### Tests and Inspections.
Bain & Mitchell, Montreal

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford

### Turbine Water Wheels.
Canadian Fairbanks Co., Montreal
Jenckes Machine Co., Sherbrooke, Que
Jas. Morrison Brass Mfg. Co., Toronto.
J. C. Wilson & Co., Glenora, Ont.

### Vacuum Regulating Valves.
Peiler & MacKenzie, Montreal

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Venetian Grates.
J. De Clercy, Montreal.

### Watt Meters.
Gas & Electric Power Co., Toronto.

### Wood Split Pulleys.
Canadian Fairbanks Co., Montreal.
Dodge Mfg. Co., Toronto.

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

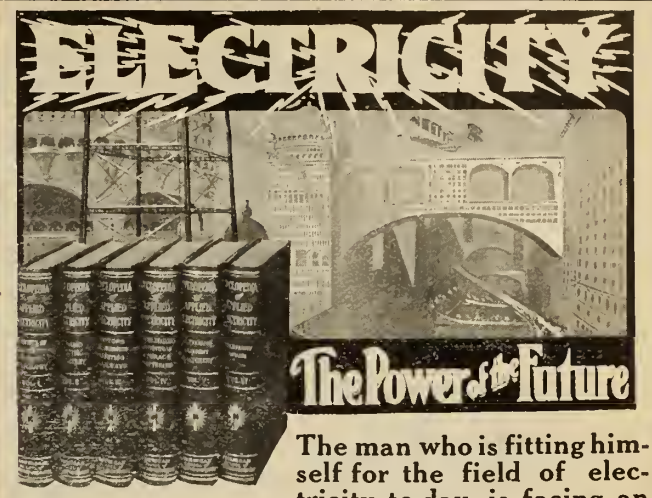
Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**






**The man who is fitting himself for the field of electricity to-day, is facing an opportunity that is almost limitless. *The power of the future is electricity*, and in this branch of science will be found the greatest possibilities for advancement.**

**The standard reference work of the up-to-date Electrician, Electrical Engineer, and all allied professions is the**

CYCLOPEDIA *of*

# APPLIED ELECTRICITY

This complete, specialized work comprises 2,896 pages of authoritative, up-to-date information. It treats of twenty-three general subjects. Its detailed index includes over 4,000 different topics. A careful revision has just been made, page for page. Every topic previously covered has been brought right down-to-date. Six Volumes, page size 7x10 inches, 2,000 special photos, sections, diagrams, etc., indexed and ready for reference.

In proof of its up-to-dateness, it is only necessary to mention that foremost among the subjects treated are Dynamo-Electric Machinery, Alternating Current Machinery, Wireless Telegraphy, Wireless and Automatic Telephony, Storage Batteries, Power Station and Transmissions, Telautograph, Electric Lighting and Railways, Electric Wiring, Telegraphone, etc.

IT COSTS NOTHING TO LOOK.

Upon receipt of coupon we will send you a set of this great Cyclopedia, by prepaid express, without deposit or guarantee of any kind. Keep the books five days, examine them carefully, give them every possible test. We want you to be the judge—you are under no obligations.

If you decide the books are not what you want, advise us and we will have them returned at our expense. If you keep the books send us $2.00 within five days, then $2.00 a month until you have paid the special price of $18.60. The regular list price is $36.00.

This special offer is good until March 1st.

IMPORTANT SUBJECTS COVERED

Management of Dynamos and Motors, Central Station Engineering; Central Station Design; Theory, Calculation, Design and Construction of Generators and Motors; Types of Dynamo and Motors: Elevators: Direct Current Motors; Electrical Measurements; Single-Phase Electric Railway; Electric Welding; Mercury Vapor Converter; Electric Telegraph; Telephony, includes Instruments, Lines, Exchanges, Common Battery Systems, Operation, Maintenance, Etc.

**FREE!** ORDER AT ONCE and we will include for one year, as a monthly supplement, the

**TECHNICAL WORLD MAGAZINE,**

A regular $1.50 monthly, presenting twentieth century facts in plain English. Latest discussions on timely topics in science, invention, discovery, industry, etc. The strongest serial of the season, "WHO OWNS THE EARTH" appears in the February issue.

**AMERICAN SCHOOL OF CORRESPONDENCE**
**CHICAGO, U.S.A.**

**FREE OFFER COUPON**

**American School of Correspondence:**

Please send Cyclopedia of Applied Electricity for FREE examination: also T.W. for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60, otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

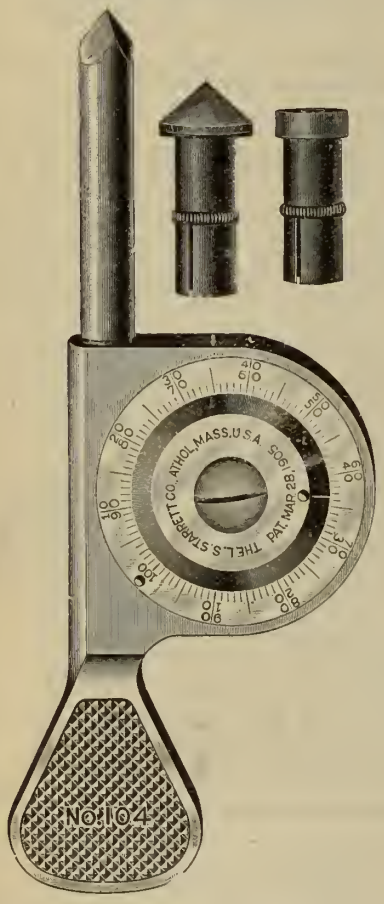
POWER HOUSE—1—09

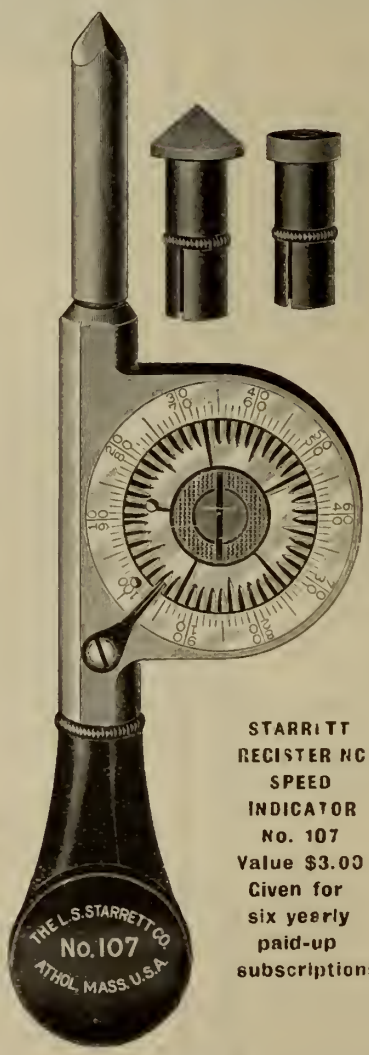
# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

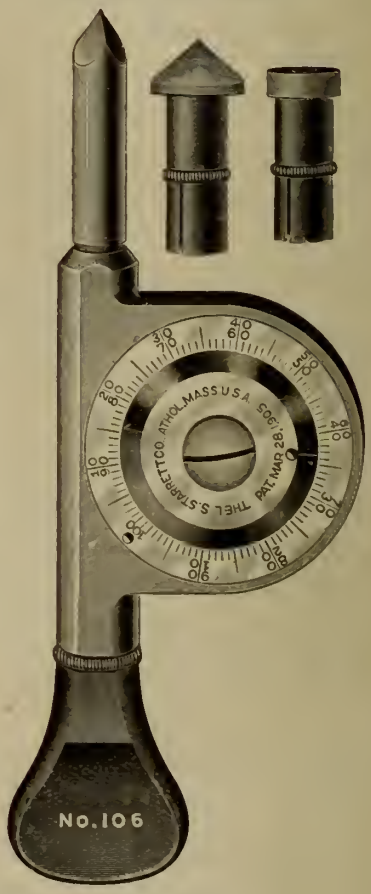
**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**




**STARRITT RECISTER NC SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

**Start in TO-DAY to earn one of these Handy Tools.**

## THE POWER HOUSE, 10 Front Street East, Toronto

# Less Friction, No Waste, 50% Greater Economy

**These are the infallible results of using any good cup grease in combination with the**

# "PHILADELPHIA" GREASE CUP

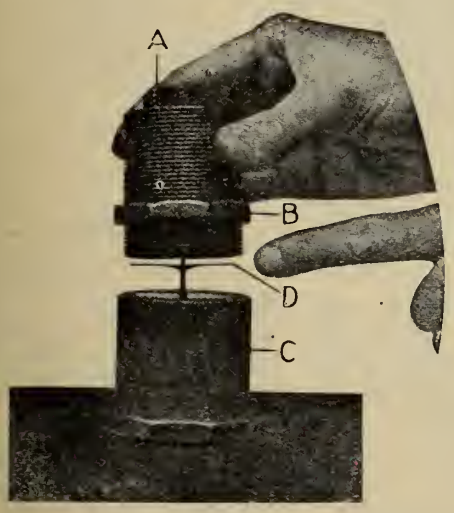



FIG. 1.
Method of filling: Screw the cup into place before filling; unscrew and remove A; fill C even full with grease, holding A as shown in cut (with locknut B and disc D in position shown) screw it into C to the position illustrated in Fig. 2. or not to exceed one-quarter its length.

¶ It is a thoroughly demonstrated fact that in most cases where liquid oil is used as a lubricant there is more waste than lubrication. Grease, or rather "solidified oil," is a much more efficient lubricant, if you can apply it properly. The Philadelphia Grease Cup overcomes every difficulty in applying grease to the journals by means of a compressed air feed. It keeps a constant film of grease between the frictional points — practically eliminating the friction. The solid character of the grease does away with all possibility of waste, and the perfect lubrication thus afforded enables you to get the best possible work out of your machines.

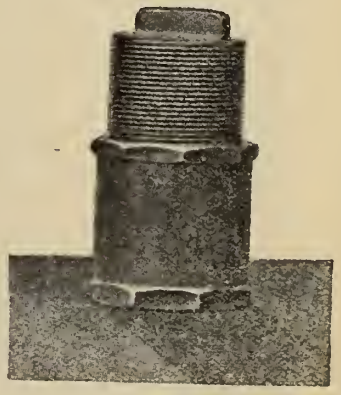


FIG. 2.
Shows cup filled with grease, the upper part screwed into place. This will suffice for a run of from one week to a month, according to the nature of the journal. In the bottom of the cup is a funnel which draws the grease to the centre so that if the grease runs low and the cup cannot be at once refilled the surplus in the funnel will be sufficient to lubricate the journal until the refilling is done.

## ALL PRACTICAL ENGINEERS

are interested in this cup. The assertions we make are fully backed up by indisputable proof. We don't expect you to take us on trust. We want to SHOW you. We expect all practical engineers who see this advertisement to write us a postal asking for full particulars, whether they are in a position to instal our cups or not. This cup is a good thing for engineers and manufacturers alike, and we want them all to know it.

*WRITE FOR PARTICULARS TO-DAY.*

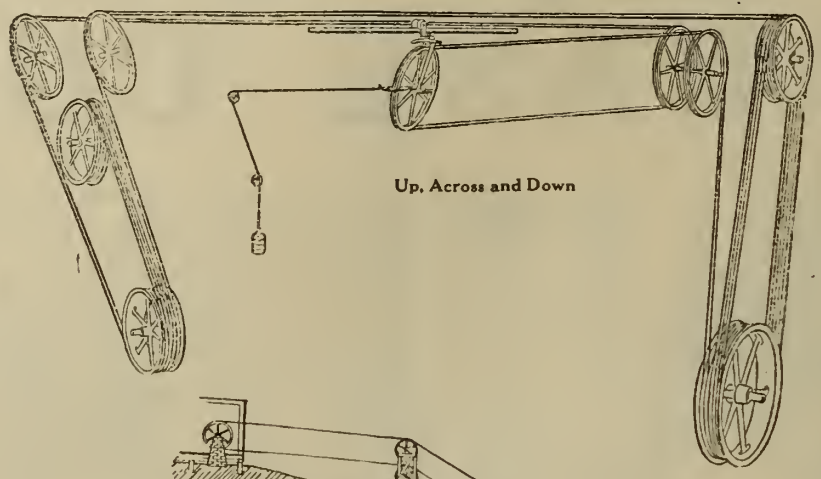
# The Peterborough Lubricator Mfg. Co. Limited

**Factory:**
**PETERBORO, CANADA.**

**Sales and Demonstration Rooms:**
**127 BAY ST., TORONTO, CANADA.**

# Rope Driving

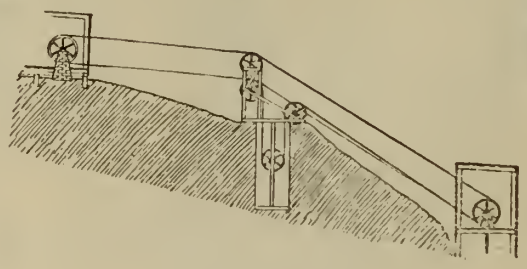
**Power transmitted in any direction to any distance in doors or out of doors.**



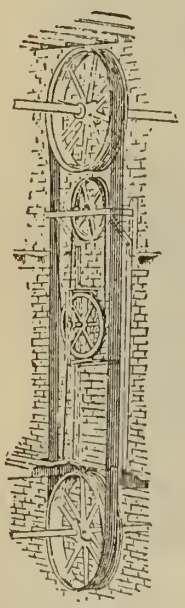
Up, Across and Down

**A Silent, Positive Drive.**

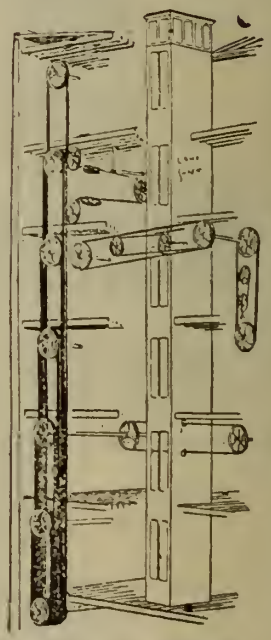
**No Slip.**



Across the Yard



Vertical Drive



Driving the Entire Building

It often happens in a mill or factory that power is wanted at some remote corner of the plant. There may be an abundance of power at the engine or main line shaft, but the question arises, how are we to get that power to where we want it, and in the most economical way? This is just where we come in! We are Rope Drive Experts. We design, manufacture and install Drives complete.

**Correspondence Invited**

## DODGE MANUFACTURING CO.

**Toronto Montreal**

# HARRIS

HEAVY PRESSURE

**Agents Wanted Everywhere**

# BABBITT METAL

The Copper-Covered Cake

Best by Actual Test
For All Machinery Bearings

**Harris Heavy Pressure Babbitt Metal** **The Copper-Covered Cake**

is a metal specially cast in a round bottom ingot which fits in an ordinary ladle and weighs 4 lbs each and having on the upper side, the profile of the founder of The Canada Metal Co., Ltd , who has given many years to the study of Bearing Metals.

*This metal is designed for general machinery purposes. It can be used for all bearings and will run cool at any speed.*

*It has easy flow, malleability, toughness, durability, and antifriction qualities.*

*We recommend it to mill owners, manufacturers, electric, steamship and railroad companies for machinery bearings of all kinds. Our guarantee is back of every pound.*

## The Canada Metal Company

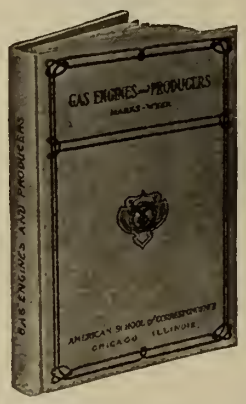
**Limited**

**Toronto : : : Ontario**

The Copper Cover protects from oxides until melted and adds to its hardness when melted. Melts in an ordinary ladle.

# The Progressive Engineer

will not hesitate to take advantage of every inexpensive opportunity to get more knowledge regarding his chosen profession—knowledge that will help him get greater efficiency from his plant, and thus attract the favorable attention of his employer. We want to tell you that we will send either of the two following books—which would cost you a dollar to get any other way—to every subscriber who sends us in one new, paid-up yearly subscription to The POWER HOUSE.

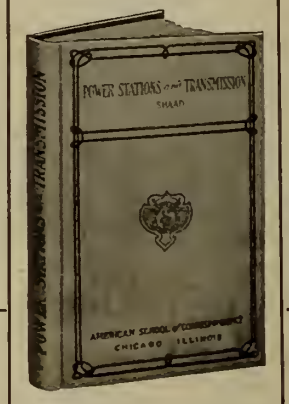



**Gas Engines and Producers**

**By Lionel S. Marks, S.B., M.M.E.**

Assistant Professor of Mechanical Engineering, Harvard University, American Society of Mechanical Engineers, and Samuel S. Wyer, Mechanical Engineer, American Society of Mechanical Engineers. 160 pp., 90 illus. Cloth binding, Embodying the latest information in this rapidly developing field. Of immense practical value to all Engineers, Machinists, power-plant owners or managers, etc.,—in fact, all interested in efficient and economical power production.

**Price.....$1.00**




**Power Stations and Transmission**

**By George C. Shaad, E.E.**

Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. 176 pp., 43 illus. Cloth binding. A manual for Electrical Engineers and Electrical Workers in general. It represents the accumulation of years of practical experience by the best authorities, and should be in the hands of every worker in the great field of electricity and of every other practical man, no matter what his business, who is interested in the development of electrical power.

**Price.....$1.00**

**Send us in a new subscription. Just try one or two of your engineer friends—tell them how well you like the paper and you will be surprised how easy it is to get the subscription. Tell us which book you want and we'll send it by return mail. . . . .**

# THE POWER HOUSE

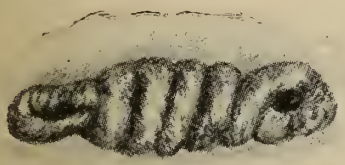
**10 Front Street East - - - Toronto**

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.

"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit.

THE MODERN JOINTING

LEAD WOOL

"SHREDDED LEAD."

MADE IN ENGLAND

## OPAL GLASS TILING

FOR WALLS OF

**MACHINERY AND POWER HOUSES**

Most approved material.

**TORONTO PLATE GLASS IMPORTING CO'Y.**

PLATE AND WINDOW GLASS

135 to 143 Victoria St., - Toronto

You can always rely on

## HERCULES Seamless Copper FLOATS

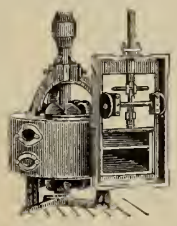
We positively guarantee both material and workmanship.

Write us for a copy of our CATALOG "C."

**Hercules Float Works**

P.O. Box 396. Springfield, Mass.

## Improved "LITTLE GIANT" TURBINE WATER WHEEL



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effieiency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

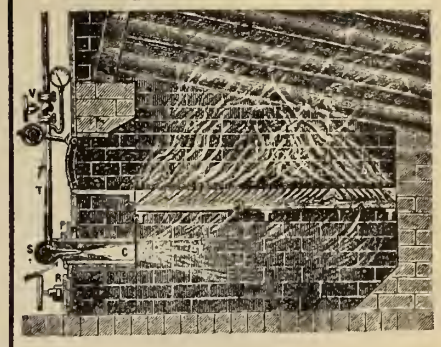
Write for descriptive catalog.

## J. C. Wilson & Co.

GLENORA, ONT.

Builders of Power Transmission Machinery

Machine-cut Wood and Iron Tooth Gearing our specialty.



# Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

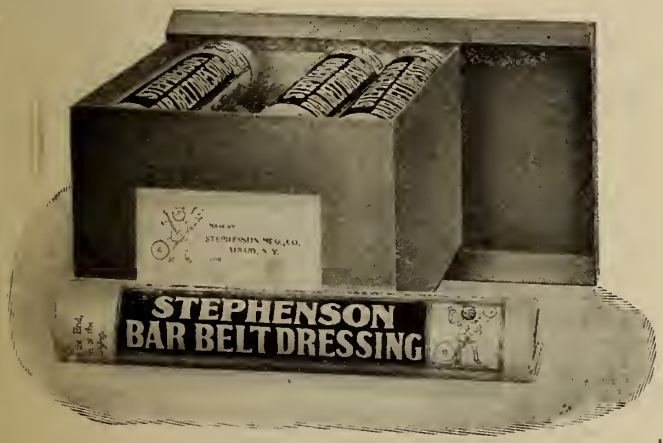
Saves 20% to 50% in your fuel bills.

*For Particulars Apply*

## J. de Clercy, C.E.

**62 Ontario St., West**

MONTREAL




## DON'T LET $4.80

stand between you and healthy, long-lived, dependable belts. Ask your dealer for a box of STEPHENSON Bar Belt Dressing, and see how quickly and gratefully your belts will respond to good treatment.

The results will delight your heart and your check book.

Be sure our registered Trade Mark—The Man with the Cog Wheel Face—is on each Pound Stick.

Don't confuse the Brands:—

RED Label Brand for Leather Belts

GREEN Label for Rubber and Canvas.

**$4.80 for a 12-lb. Box**

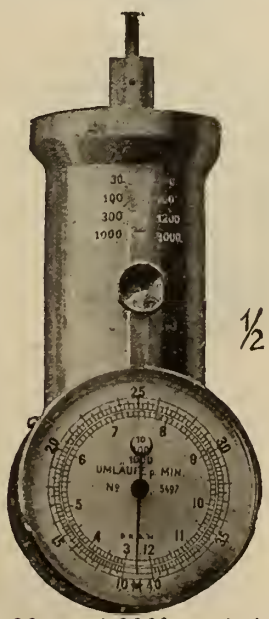
**Of Dealers everywhere, or**

## Stephenson Manufacturing Co.

ALBANY, N. Y.

## HAND TACHOMETERS

No watch required for readings.



½ full size.

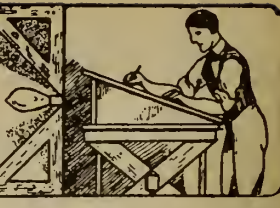
Registers from 30 to 4,000 revolutions per minute **without using a watch.**

## Schuchardt & Schutte

**91 Youville Square, MONTREAL**

**New York, London, Shanghai, Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen, Budapest**

# PROFESSIONAL DIRECTORY




**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

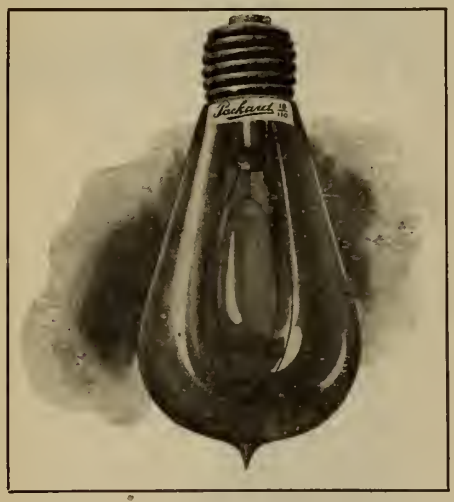
**JULES DE CLERCY, M.E.**
GAS ENGINEER
Expert knowledge of all classes of Engines and Producer Plants. If you are thinking of installing a Gas Engine or Producer Plant write me. If your plant is not working satisfactorily I can help you.
62 Ontario St. West, - MONTREAL, QUE.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327
702 Canadian Express Bldg., MONTREAL

**RODERICK J. PARKE**
A.M. Can. Soc. C.E. — A.M. Amer. Inst. E.E.
Consulting Electrical Engineer
INDUSTRIAL STEAM AND ELECTRIC POWER PLANTS DESIGNED, TESTS REPORTS
205 Yonge St., Bank of Toronto Bldg., TORONTO
Long Distance Telephone—Office and Residence

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Estimates, Reports, Plans and Specifications. Supervision of Power. Lighting and Railway Installat
Liverpool London and Globe Bldg., MONTREAL




**Incandescent Lamps**

*Packard*

The Old Reliable
Used Everywhere

*All Standard Candle Powers and Voltages.*

**The Packard Electric Co., Limited**

Head Office and Works: St. Catharines, Ont.

Branch Offices:
Montreal
Winnipeg

# To the **Central Station Engineers** of Canada

A number of Central Stations have already requested our services for their *annual Fall preparation* for the heavy winter load, but there are a number of you from whom we have not heard.

We wish to thank those of you who have favored us with orders and also to assure the hesitant ones that their work will receive the same *careful and prompt attention* which has made our old customers our good business friends.

When sending in your work, we would be pleased to have your suggestions for changes your daily observation of the machine has shown necessary.

*REMEMBER*

## The Electrical Maintenance & Repairs Co.

**162 Adelaide Street West, TORONTO**
**Phone Main 3419**

*The Specialists in the Cure of Electrical Diseases.*

# The General Electric Manufacturing Co. of Sweden

**FOUNDED 1883**
Factories in Westeras, Sweden; London, England Helsingfors, Finland.

**(ALLMANNA SVENSKA ELEKTRISKA)**

4,500 K.W., 257 R.P.M., 6,600 Volt., A.C. Generator, Water-wheel Type.

**Some reasons why you should consider our apparatus:**

- Moderate prices.
- All apparatus guaranteed during one year.
- 25 years of experience in the design and manufacture of electrical apparatus.
- Extremely rugged and reliable construction.
- Only best grade Swedish iron and steel used.
- Highest efficiencies.
- Spare parts carried in stock in Toronto.
- Our own skilled labor for erection and repairs.
- Actual shipping time only three weeks between factory and Ontario points.
- 3-Phase Motors in stock in Toronto.

*We solicit an opportunity of tendering on all your requirements.*

**REPRESENTATIVES IN CANADA:**

## Kilmer, Pullen & Burnham,

**508 McKinnon Building, TORONTO**

# Why are J.M.T. valves so universally used?

## If you don't know, ask any engineer who has used them, he'll tell you why.

Made in all the Standard Patterns J.M.T. Standard and Extra Heavy weight.

J.M.T Brass Globe Valves
" Iron " "
" Brass Angle Valves
" Iron " "
" Brass Check Valves
" Iron " "
" Brass Swing Check Valves
" Iron " "
" Brass Cushion Check Valves
" Brass Radiator Valves
" Brass Y Blow-off Valves and others.

Sold all over the Dominion. - Look for Trade Mark on every Valve.

---

## The James Morrison Brass Mfg. Co., Limited

93-97 Adelaide Street West - TORONTO

*High-Grade Engineers' Supplies and Steam Specialties.*

CIRCULATES IN EVERY PROVINCE OF CANADA

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. II. Publication Office, Toronto — February, 1909 No. 2

"THEY ALWAYS WORK"

LOOK FOR

TRADE PENBERTHY MARK.

THE TRADE MARK
IT'S YOUR GUARANTEE

# PENBERTHY

Sight Feed Lubricators are made to satisfy particular engineers.

## Some Special Features

The filler D and gage glass C are combined in one arm. Note the position of the gage glass—at the top of the body. In this location the amount of oil in the cup can be gaged up to the last drop. You, therefore, only have to re-fill the cup when it is really necessary. In other lubricators the gage glass does not register the amount of oil after the Cup is two-thirds empty and you have to refill oftener than is necessary to make the gage glass show the level of the oil.

The oil regulating valve K and the valve L for draining the sight feed chamber I are combined in one stem but operate entirely independent of each other.

The drain valves L and B cannot jar off. They will unscrew only to a stop but sufficient to allow the water to drain out.

We have adopted the disc shaped glasses which are not easily broken and which can be removed by simply unscrewing the glass nut.

MANUFACTURED BY

**Penberthy Injector Co. Limited, Windsor, Ont.**

Double Connection

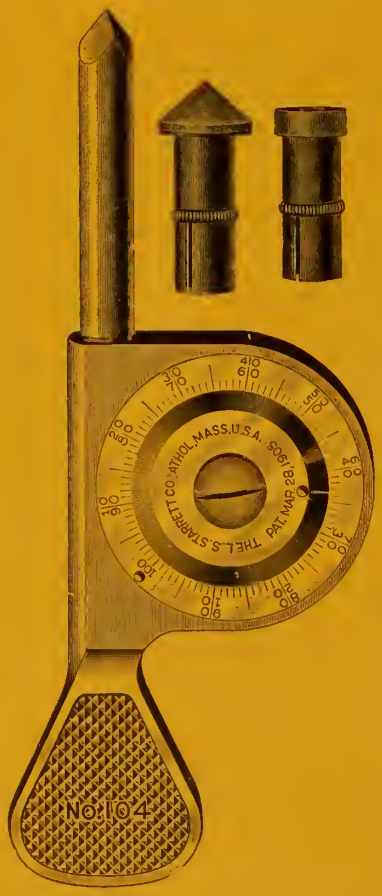
Sight-Feed Steam Lubricator for Stationary Engines

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**



**STARRETT REGISTERING SPEED INDICATOR No. 107**
**Value $3.00**
**Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106**
**Value $1.50**
**Given for three yearly paid-up subscriptions.**

"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

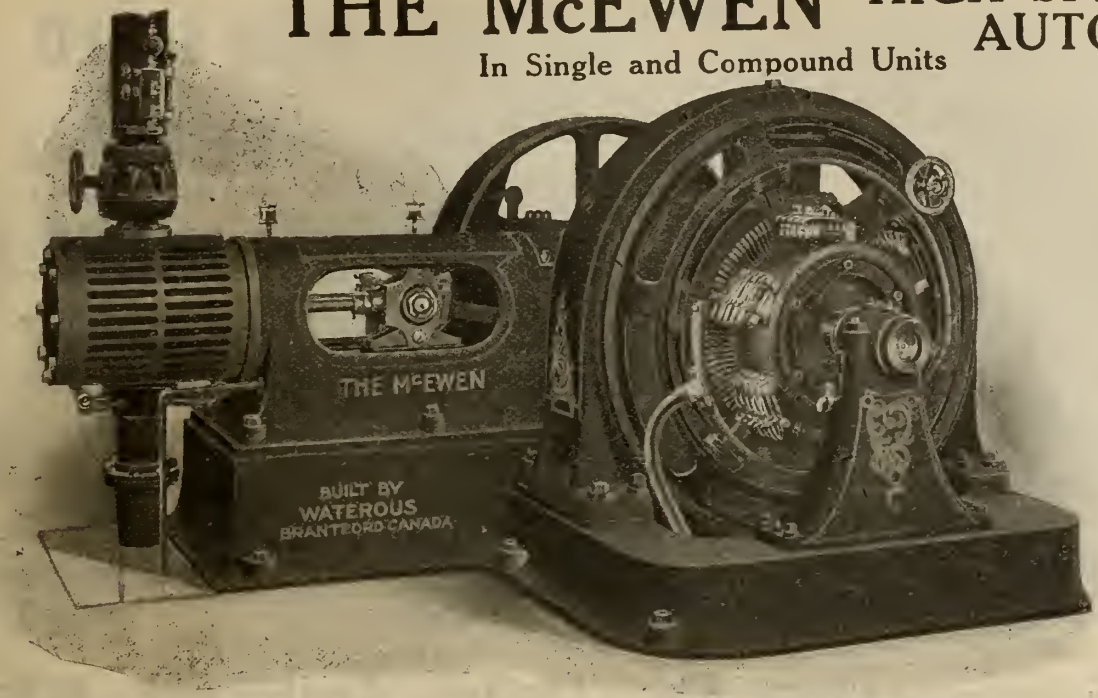
PUBLISHED MONTHLY AT $1.00 PER YEAR.

Start in TO-DAY to earn one of these Handy Tools.

**THE POWER HOUSE, 10 Front Street East, Toronto**

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units




**Specially Suited for Direct Connected Electrical Works.**

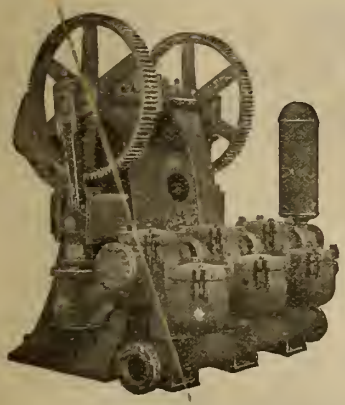
Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

**BRANTFORD, - ONTARIO**

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver



## On Account

of their Ex'remely Low Cost of Operation and the Small Amount of Attention Required

## Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

## Goulds Pump Co.

Coristine Bldg., Montreal

**Phone Main 1054**

*Works - - - - - - Seneca Falls, N.Y.*

## The Brownell Company

**Dayton, - Ohio**

**Branch Offices:**

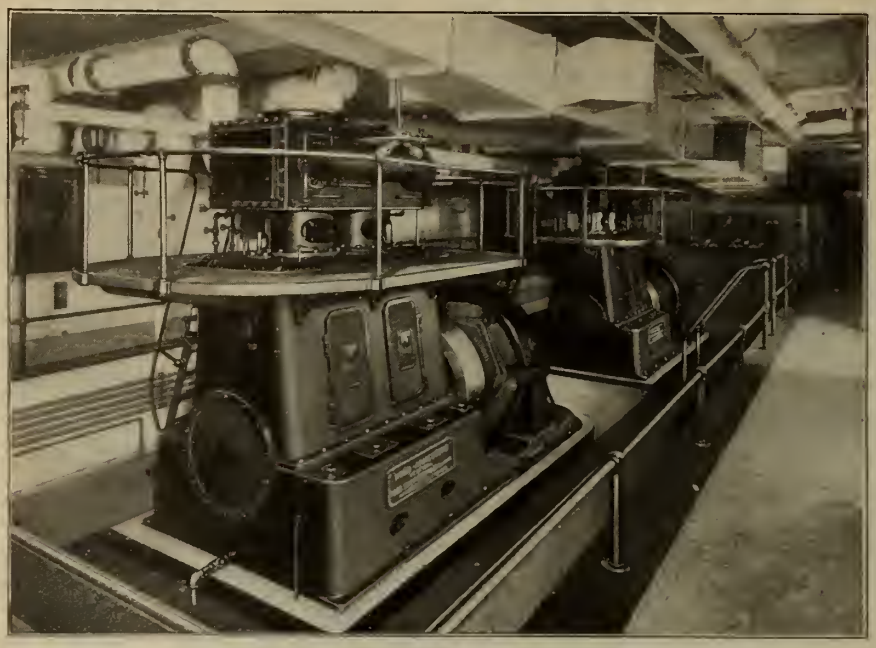
401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

**Manufacturers of**

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.



# HIGH SPEED VERTICAL ENGINES

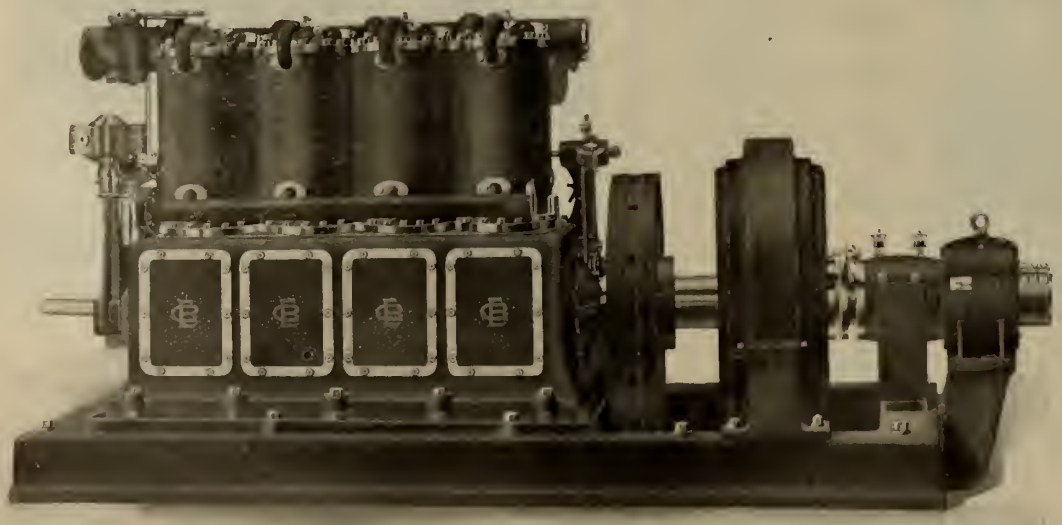
of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES { Traders Bank Building, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
Union Bank Building, WINNIPEG ; J. F. Porter, Manager

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants  Pressure Gas Plants

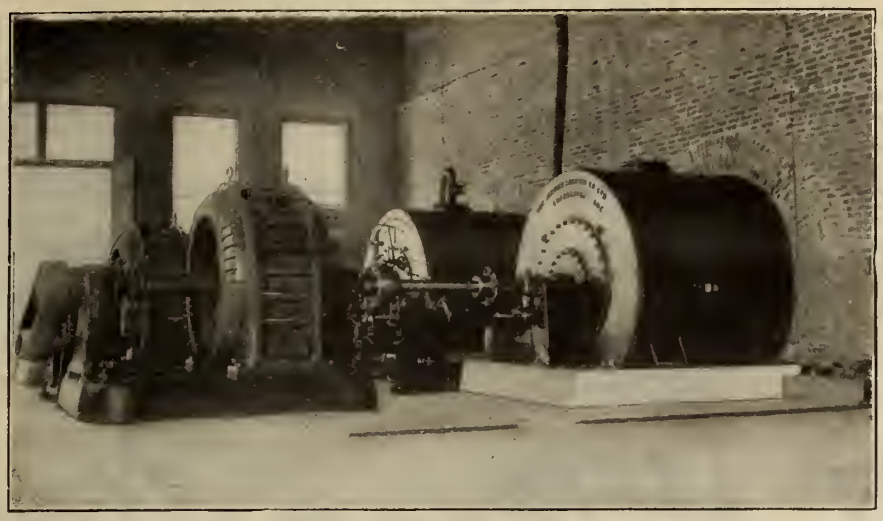


Engine direct connected to alternators, guaranteed to run in parallel successfully.

Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.
**Stair Building, Bay Street - TORONTO**



In developing a water power the design of the installation and the performance of the Turbine are of equal importance.
We design plants to suit the location and our experience in this line will be of value to intending purchasers.
The performance of our Improved Turbine ensures the best results from a well designed installation.

May we send you our new Turbine Catalogue.

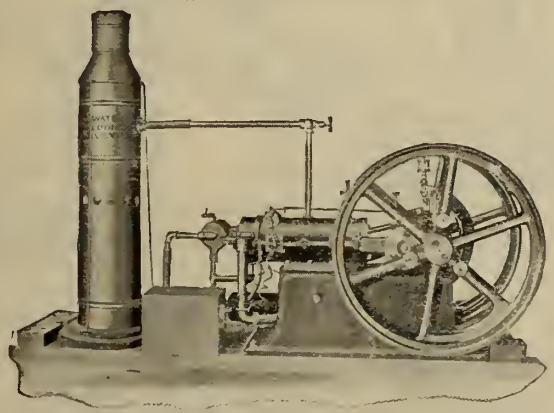
## The Jenckes Machine Company Limited

Sherbrooke St. Catharines Cobalt Vancouver Halifax

Works : Sherbrooke, Que. ; St. Catharines, Ont.

## GAS and GASOLINE ENGINES

1½ to 25 H.P.

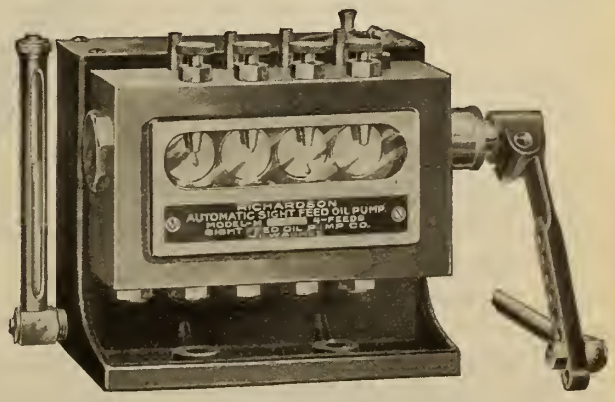


If interested it will pay you to write for our Catalogue

**Goold, Shapley & Muir Co.**
Limited

BRANTFORD - CANADA

## The Model "M" Method




You would not shoot at a flock of birds with a rifle! You would not sow seed with a shovel! A rushing stream of steam will not efficiently charge itself with oil that is introduced spasmodically in quantities, and the oil that is introduced is only partially effective; a large percentage dodges right on thru the engine and is lost.

The Model "M" Method is to introduce a less amount of oil in very small quantities at every engine stroke. It is an interesting story, and we would like to tell you all about it.

Bulletin No. 109-L.

Manufactured by

**SIGHT FEED OIL PUMP CO.**

MILWAUKEE, WIS., U.S.A.

# Every Inch is Reliable!

You want belting that can be absolutely relied upon all the time; that won't slip or crack; that grips the wheel and revolves the shafting without any waste of power. Then, use

## D. K. McLaren, Limited

**GENUINE OAK TANNED**

## Leather Belting

It is the belting that is best for your business. Every inch is sound quality all the way through—made only from the backs of superior hides; bellies, shoulders and necks are cut away before tanning. Our Belting is all Genuine British Oak Tanned—not to be confused with the inferior hemlock tanning often called "oak" tanning.

PRICE LIST ON REQUEST

## D. K. McLAREN, LIMITED

MONTREAL
309-311 Craig Street West

TORONTO
200 King Street West

QUEBEC
21 St. Peter Street

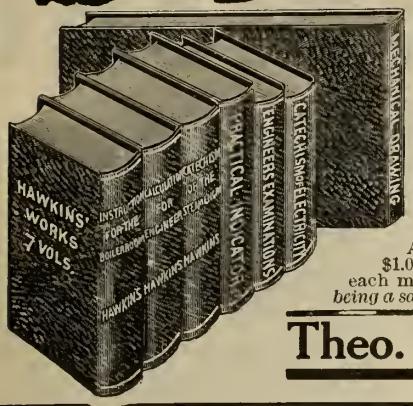
ST. JOHN, N.B.
64 Prince William Street

WINNIPEG
Fred. J. C. Cox & Co., Representatives

VANCOUVER
418 Abbott Street

Full stock of our "Extra C" Leather Belting and "D.K." Balata at above addresses.

*Hawkins' Works*


HAWKINS' WORKS 7 VOLS.
MECHANICAL DRAWING
CATECHISM OF ELECTRICITY
ENGINEERS EXAMINATIONS
PRACTICAL KINKS
HAWKINS' NEW CATECHISM OF THE STEAM ENGINE FOR ENGINEERS AND FIREMEN

## On Easy Payments.

Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

**SPECIAL OFFER** Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month *(when complete set is purchased the price is $12, being a saving of One Dollar)*. **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

(X) HERE

| | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed ..... (Firm Name)

Home Address .....

# Now Look Here All You Belt Users

What is the use of beating about the bush and trying to economize by the use of cheap belting? You **will** have to get the best in the end, so why experiment at **your own** expense? **We** have done all the experimenting and offer you the **perfected results.** We **tan our own leather** and make all our own belts in an up-to-date factory by up-to-date methods.

OUR BRANDS:

"ACME WATERPROOF," "EXTRA," "STANDARD," Etc.

SHALL WE SEND YOU PARTICULARS?

## J. L. GOODHUE & CO.

**Danville, Que.**

WATERPROOF BELTING

OFFICES & FACTORIES MONTREAL TORONTO

"AMPHIBIA"

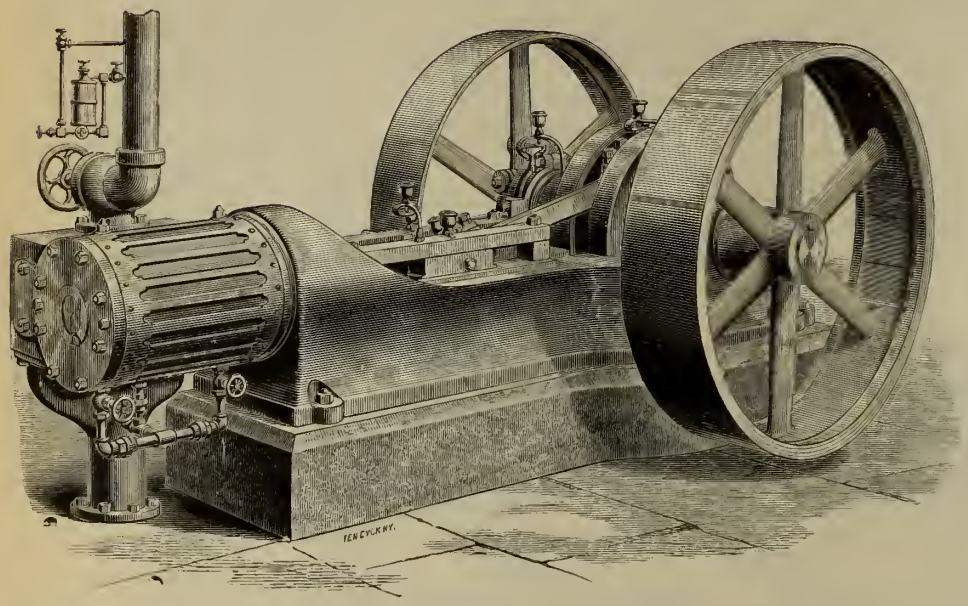
BRANCHES ST. JOHN, N.B. CALGARY WINNIPEG VANCOUVER

*TRY THIS*

*on the drives that the Belting requires to withstand water, steam or dampness of any kind.*

SADLER & HAWORTH

# Power Equipment



Automatic Engines
Horizontal Engines
Marine Engines
Vertical Engines
Fire Box Boilers
Horizontal Boilers
Marine Boilers
Vertical Boilers
Hoisting Engines
Gasoline Engines
Electric Motors
Water Wheels

Our supply catalogue or machinery stock list for the asking

## H. W. PETRIE, Limited

TORONTO MONTREAL VANCOUVER

---

It is not what you pay for an article, but what the article pays you in return for its cost, that determines its value.

We represent Manufacturers of

## Reliable Engineering Specialties

and solicit enquiries

(Genuine) **ASHTON** Pop Valves, Relief Valves, Gauges, etc.

**MASON** Reducing Valves, Pump, Damper, Pressure and other Regulators.

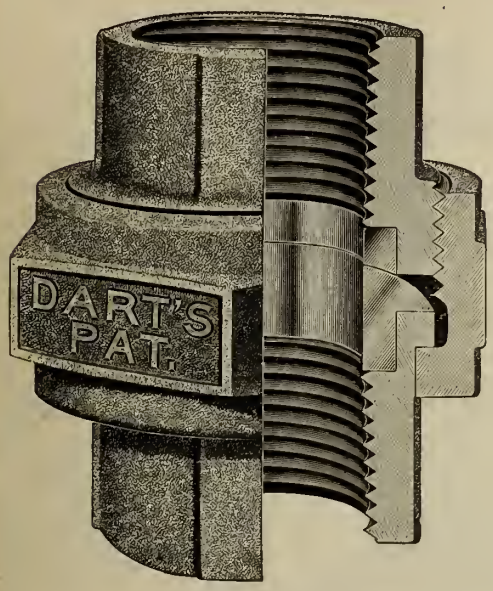
BERRY Boiler Feed Control
BAT Water and Electrical Meters
POWERS Automatic Temperature Regulation
BUNDY Steam Traps for all Services
OSBORN'S Famous Mining and Tool Steels

All just a little better than the best.

If we can be of service, write us for particulars.

**PEILER & MacKENZIE,** 17 St. John St., **Montreal**

# Why Monkey With Leaky Unions?




# DART'S

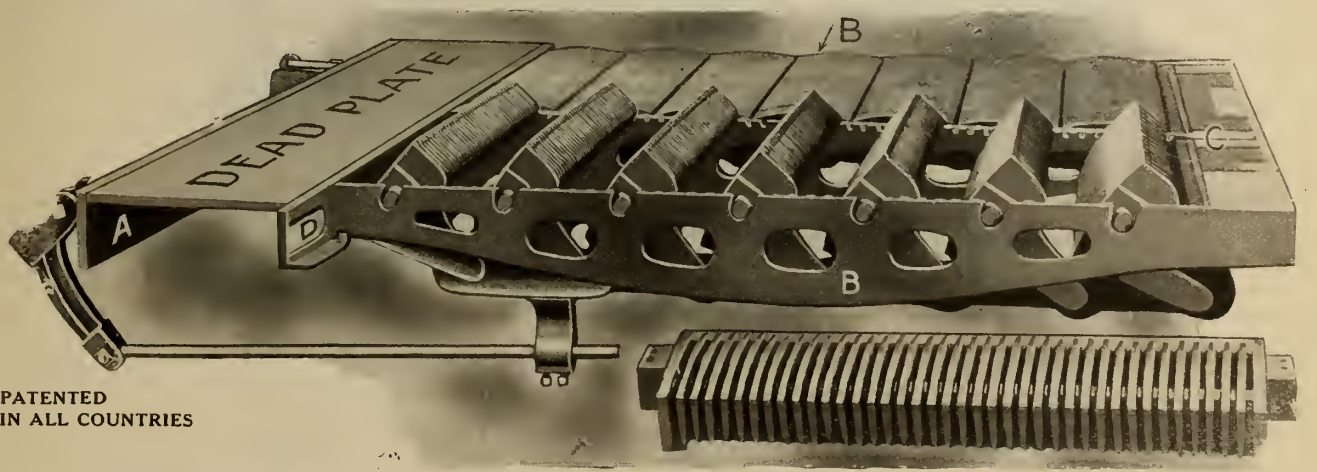
## PATENT UNIONS ARE ABSOLUTELY RELIABLE

We make them so by using bronze against bronze at the joint.

## DART UNION CO. Limited

93-97 NIAGARA ST. - - TORONTO, ONTARIO

# The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES

The section of the grate shown nearest the reader is in the Dumping Position; that in the rear is shown level, or ready for the fire. In shaking, the bars are rocked backward and forward slightly, so as to sift the fine ashes through only.

### What we claim for the Cyclone Shaking and Dumping Grate.

A Perfect Shaking Grate. The fire always clean.
A Perfect Dumping Grate. Clinkers Dumped without pulling them out on the floor.
Greater Air Space than any other grate on the market; therefore—perfect combustion.
Perfectly balanced; therefore easy to operate in shaking or dumping.
Will burn any kind or size of coal or wood on the market; either hard or soft, lump or slack, good or bad, therefore—great economy.
Great simplicity of design and strength of parts; therefore—long life.
Easily and quickly installed; therefore—no shut down of plant necessary. No expensive changes in the brickwork needed.
Will effect a saving in the fuel bill of from 5 to 20 per cent. in any plant.
Guaranteed to last longer than any other bar manufactured.

**Is being used by nearly all of the larger concerns in Canada.**

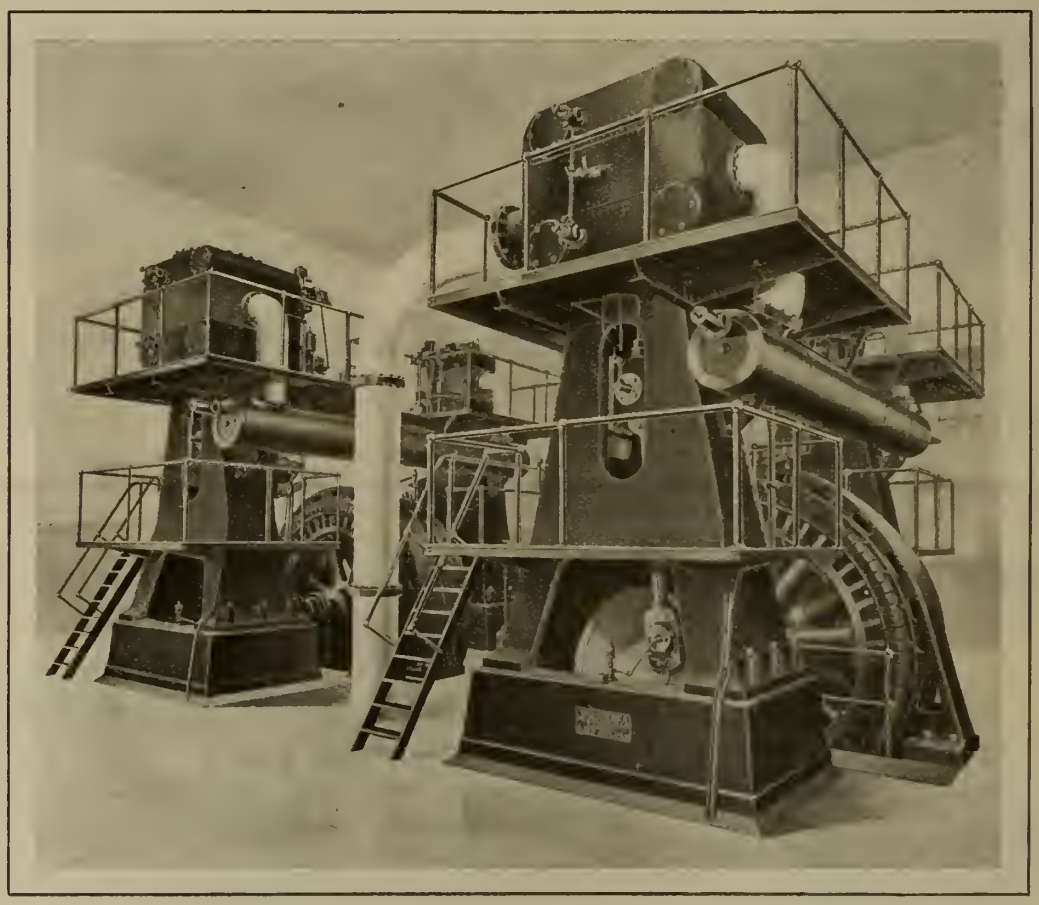
**All Infringements will be Vigorously Prosecuted.**

## CANADIAN STEAM BOILER EQUIPMENT CO., LIMITED

36 and 38 Lombard Street, - TORONTO

# POWER EQUIPMENT

**Goldie Corliss, Wheelock Slow Speed and Ideal High Speed Steam Engines. Boilers, Heaters, Pumps and Condensers. Transmission and Elevating Machinery.**



The Power House of the **Dominion Iron & Steel Co.'s Plant** at **Sydney, N.S.** Equipped with two pair of **Vertical Cross Compound Goldie Corliss Engines.**

*ASK FOR CATALOGUES, PRICES AND ALL INFORMATION*

## The Goldie & McCulloch Co., Limited

### GALT, ONTARIO, CANADA

WESTERN BRANCH,
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS,
Ross & Greig, Montreal, Que.

B. C. SELLING AGENTS,
Robt. Hamilton & Co., Vancouver, B.C.

Fig. 1.—General Development at Shawinigan Falls.

# The Power Development at Shawinigan Falls, Quebec

## A General Description of the Source of Power—The Generating Station —Some of the Transmission Lines, Sub-stations, Apparatus, Etc.

Any water power plant which is to be utilized for the supply of power to distant customers, in order to be a success, must fulfill several widely different conditions. The supply of water must be reliable. This involves a condition, which, carried to the extreme, would mean a continuous supply of constant value. Very few water powers have this desirable asset and the basis of comparison is usually the amount of water flow at the minimum, with the condition that the high water period should not be so extreme as to affect the operation of the plant.

The second condition which a successful water power should meet is a question of size. In order to supply power to distant communities it is necessary that the development be made on a sufficiently large scale, so that the cost per horse-power may be kept low.

The third condition is that the power plant should be located at a distance not exceeding 200 miles from a market.

The fourth condition which a plant to be a success should fulfill is with the market, so that it would not be obliged to meet in competition other powers which can be produced more economically.

These various conditions have been outlined so that the reader may see how well the power development at Shawinigan Falls, Que., fulfills these major premises and how such a plant should meet with success.

The source of power is the St. Maurice river, which rises near the divide between the valley of the St. Lawrence and that of Hudson's Bay, at a point about 300 miles north of the power development at Shawinigan Falls. The St. Maurice river, with its tributaries, drains an area of about 20,000 square miles. Practically all of this area is now forest and is likely to remain so for many years, as the country is not suitable for agricultural purposes. This whole area is thickly interspersed with lakes, so that the flow of the St. Maurice river is much more constant than most rivers of its size.

For a distance of about four miles above the falls at Shawinigan, the river broadens out into what is practically a lake. At the foot of the falls is another lake, the difference in level between the two being about 150 feet. At the crest of the falls a ledge of rock forms a natural dam, the water directly above the crest being about 20 feet deep at the ordinary stages of the river.

### Power Development.

In the original instalation of the power plant, beginning in 1898, the discharge of the St. Maurice river was utilized at the point where the Shawinigan Falls

give a total head of about 150 feet. The working head is about 130 feet, with a flow of approximately 10,000 cubic feet of water per second. This amount of water will develop an electric power of about 100,000 horse-power, and by utilizing the various lakes on the watershed for storage purposes, this capacity can be largely increased.

The first development was made by excavating a canal or forebay from a point near the crest of the falls, about one thousand feet to the west, the end of this canal being closed by a concrete wall, in which are the head-gates and the entrance to the penstocks. From the forebay wall penstocks about four hundred and fifty feet in length conduct the water to the power house at the level of the lower lake. The canal is 20 feet deep at low water and 100 feet wide, and of sufficient capacity to develop 75,000 horse-power. The excavation is entirely in granite rock. The forebay wall is so constructed that it can be extended as required to utilize the full capacity of the canal.

### Power House.

The power house is a fireproof structure built entirely of concrete, brick and steel. An electric traveling crane of 50 tons capacity runs the whole length of the building. This building is approximately 75 feet wide by 250 feet long.

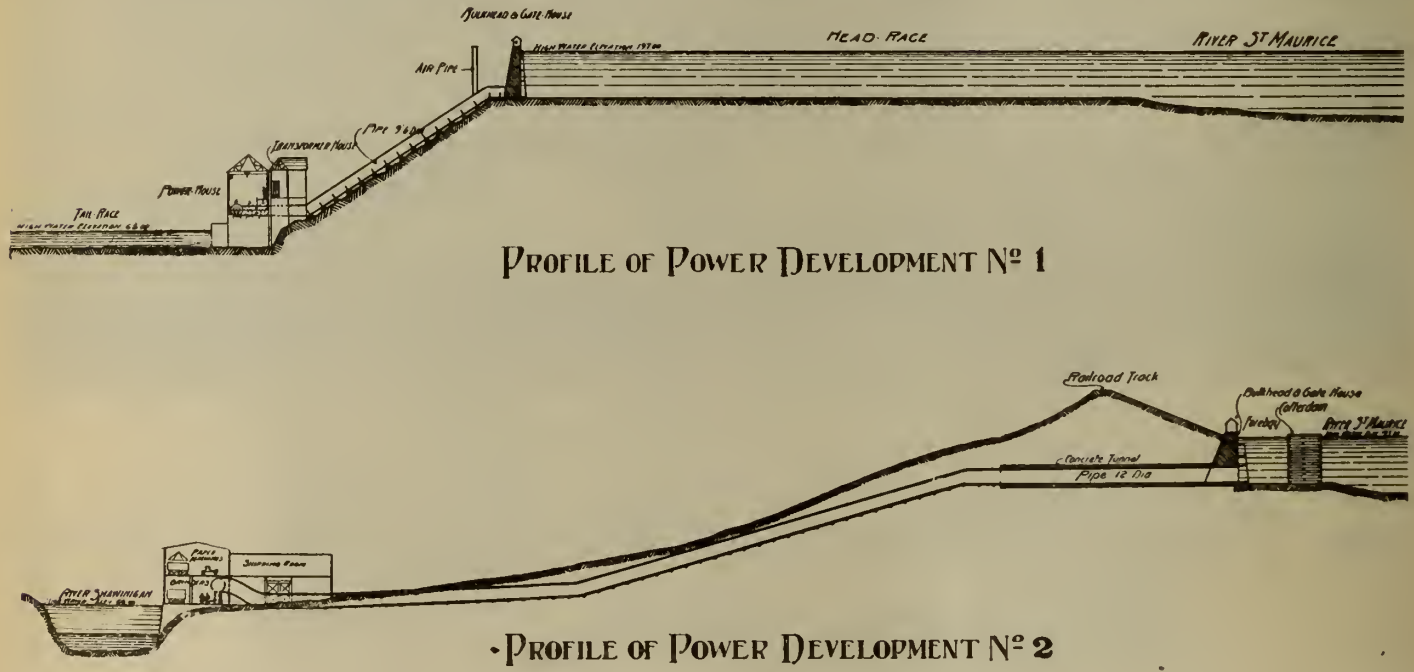
The instalation consists of one water turbine of 6,000, two water turbines of 9,000, and two of 11,000 horse-power capacity. The water turbines are directly connected to the generators, which are all two-phase, 30-cycle, 2200-volt machines. All of the turbines operate at 180 r.p.m., at a head of 135 feet. The larger machines are of exceptionally high efficieney, delivering over 85 per cent. of the power put into the water-wheel when operating at full load. Plans are completed and contracts are let for a sixth unit, consisting of an 11,000 horse-power water wheel direct coupled to a generator of the same capacity.

An interesting feature about the two 9,000 h.p. units spoken of above is that there are two generators in each unit, on the same shaft. The original instalation consisted of two 6,000 h.p. machines direct connected to the water wheels. The additional machines were set up in position with one the flanges of the coupling left blank. They were then run separately and when they were exactly in parallel a chisel mark was made on the two flanges, which were then taken off and the blank drilled from the other as a template.

The exciter equipment consists of three separate turbine units of 400 h.p. each direct coupled to continuous current generators, which operate at 120 volts. Any one of these exciters is sufficient to operate the whole station. Under ordinary conditions, however, two of these machines are in use, the third one being held as a spare.

The switch room consists of two floors. On the upper floor are located the switchboard panels, which are so arranged that each panel controls two banks of transformers. The control of large amounts of power is thus concentrated in a comparatively short distance without losing the benefits of the panel system of control. The two Montreal lines, the transmission line to the asbestos region, and the line supplying the calcium carbide works are the main feeders which are supplied from this switchboard. In addition to these are some smaller feeders, supplying power for local lighting and power purposes, and for the operation of a single-phase electric railway.

For each line there is a master switch which controls all of the transformers, supplying power to that line, so that in case of trouble the operator can open any circuit by operating a single switch, or this switch may be operated automatically. Beneath the gallery are located the oil switches, selector switches, bus bars, and instrument transformers. The bus bar system is simple, there being two main sets of bus bars, which may be connected in parallel by an oil switch. Each generator supplies power through its own oil switch to a selector switch, which may be connected to either or both bus bars. From these bars the power passes through selector switches to the feeder oil switches and then to the transformers. All power, which is sent out from the power station at Shawinigan Falls, passes through the transformers before going to overhead lines. The bus bars cables, oil switches, etc., are surrounded by concrete and brick partitions to reduce to a minimum any damage from short circuits. All of the wiring in the station is done by lead-covered paper insulated cable laid in ducts in the floor of the power house.




Profile of Power Development No 1

Profile of Power Development No 2

Fig. 2.—Profiles of Developments at Shawinigan Falls.

### Transformer House.

From the feeder switches power is supplied to the low tension side of the step-up transformers. These transform-

ers are situated in a brick and concrete building parallel to the power house and located very close to that building. Installed in this transformer house are transformers of 36,000 kw. capacity, which are divided between the four main circuits. The largest capacity is on the two Montreal transmission lines. There are transformers of 6,600 k.w. capacity on the lines supplying power to the asbestos region, and a similar amount on the carbide lines. The long distance lines to Montreal and the asbestos region are operated at 50,000 volts. All of the transmission lines are three-phase, the generator current being transformed by means of a Scott connection on the stepped-up transformers at each end. Reverse current relays are installed in the Montreal terminal station, so that in case of trouble on either transmission line the line affected will be automatically disconnected from the low tension bus bar at the terminal station. At the generating station in Shawinigan there is also a high tension testing bus bar, by the use of which any transmission line may be tested at full line voltage without using either transformer or generator capacity, which might be required on other parts of the system.

The transmission line supplying power to the asbestos region furnishes energy to a number of sub-stations scattered over the mining district. From these sub-stations power is supplied direct to the asbestos mines and mills, and used at 2,200 volts, 30 cycle. Owing to the nature of the business the load is quite variable, and, in order to take care of the voltage fluctuations, a voltage regulator was installed at the power house. This machine was built by the General Electric Company, and accomplishes the result for which it was installed in a satisfactory manner.

The voltage delivered to the sub-station at Thetford Mines, located 100 miles from the power house, is practically constant, regardless of the large fluctuations on the system. The voltage in fact is so good that it is used for lighting purposes in this district, and has been found very satisfactory for this purpose.

### Second Hydraulic Development.

For the purpose of furnishing water to factories desiring to instal their own water wheels in their mills, a second development was made about a half mile upstream from the canal of the first or main development. Here a concrete forebay was constructed, from which penstocks run to the mills, discharging their water into the lower lake.

The forebay for the second development was built on the shore of the upper lake, where the depth of water at the lowest stages of the river is not less than twenty-five feet. This forebay wall is built of concrete, forty feet high and twenty-five feet thick at the bottom. The penstocks, each twelve feet in diameter, are built in the concrete wall, extending through the embankment and down to the lower level.

The longer penstock is carried into a tunnel, which is lined with reinforced concrete. This tunnel is about 1,000 feet long, and is carried some 60 feet below the surface of the ground. The tunnel terminates in a heavy steel penstock, which conveys water to the No.

Fig. 3.—Interior of Power Plant, Shawinigan Falls.

ers. Power is supplied to the calcium carbide factory at 25,000 volts.

Outside of the transformer house is located a system of high tension bus bars, which is so arranged that any line may be fed from any bank of transformers, or lines may be operated in parallel on the high tension side. Under ordinary conditions, however, the lines are operated in parallel on the low tension side of the transformers.

### Transmission Lines.

There are two transmission lines to Montreal which are connected in parallel on the low tension side of the trans-

2 power house of the Northern Aluminum Company.

### Belgo-Canadian Company's Mill.

The other penstock from this second development is used by the Belgo-Canadian Pulp & Paper Company.

The mill is built on the bank of the Shawinigan River. Twelve grinders, together with wet machines, presses and other necessary machinery, using 12,000 horse-power, are installed for the manufacture of ground pulp and paper. The mill has a capacity of one hundred tons per day (dry weight of pulp). Three paper machines are installed, with an output of 75 tons of paper per day. The Belgo-Canadian Company are preparing to put in additional machines and propose immediately to add plant for producing sulphite pulp.

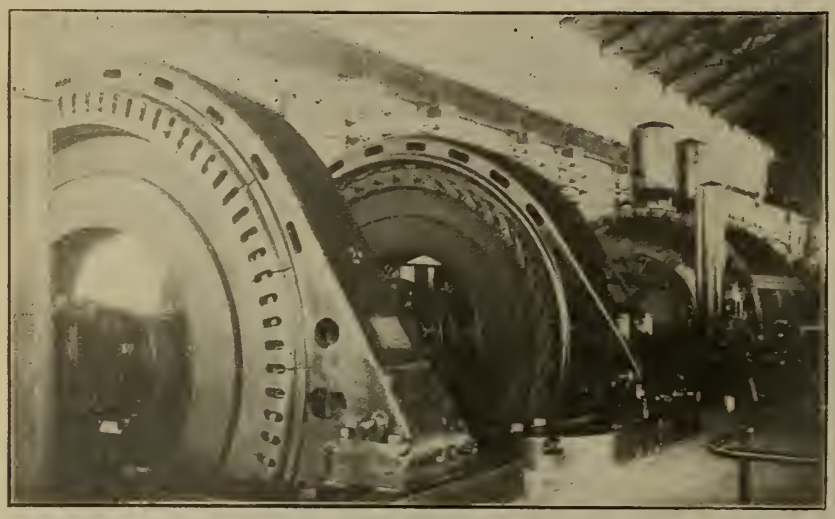


Fig. 4.—9,000 h.p. Unit Showing two Generators on the same Shaft, Main Power Station Shawinigan Falls.

### Northern Aluminum Company.

The Northern Aluminum Company was the first company to take power at Shawinigan Falls. The Shawinigan Water & Power Company supplied the Northern Aluminum Company with water to operate the Aluminum Company's first power house, in 1901, with 5,000 h.p. The Aluminum Company at that time had completed the power house, mills, etc., by which metallic aluminum was manufactured by the so-called Hall process. This company's business grew to such an extent that in 1906 they were using 10,000 h.p., and in 1907 they put into operation a new power house, mills, etc., by which this amount of power was more than doubled. The water for this second power plant is taken from the second power development described above.

### Shawinigan Carbide Company.

From the main power house of the Shawinigan Water & Power Company power is supplied to the Shawinigan Carbide Co., Ltd., as stated in the first part of this article. The plant of the Shawinigan Carbide Company is located about two miles from the power house of the Shawinigan Water & Power Company. Current is supplied at 25,000 volts, 2 phase, and is reduced at the transformer house of the carbide company to a low voltage suitable for use in operating the furnaces. The plant of the carbide company is a good example of modern mill construction, the mill being all of fireproof material. There are three main buildings; the factory building, the boiler house and the laboratory building. Besides these are the storehouse and office building. The main building is about 300 feet long and 80 feet wide. One end is five storeys in height and there are elevators and conveyors, together with storage bins and dust collecting system. Here it is that the raw materials are unloaded from the cars, stored, crushed and mixed ready to be supplied to the electric furnaces as required. The main part of this building consists of a furnace room with a transformer room along one side, but separated from the furnace room by a brick wall. Above the transformer room is the regulator room where are installed the regulators for controlling the current in the electric furnaces. Besides the transformers supplying power to the electric furnaces are: two 175 k.w. transformers which are used to reduce the voltage supply to 220 volts for the operation of motors throughout the building.

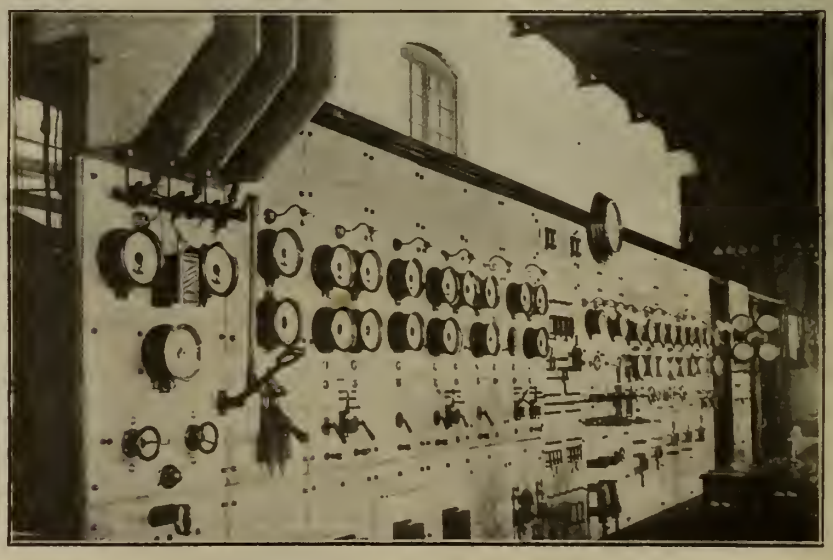


Fig. 5.—Switchboard in Power Station, Shawinigan Falls.

### The Montreal Transmission Lines.

There are two transmission lines to Montreal. The No. 1 line is located along the Canadian Northern Quebec Railway between Shawinigan Falls and Joliette, a city fifty miles from Shawinigan. From this point the line runs across country until it intersects the Canadian Northern Railway again near L'Assomption, P.Q. From this point into Montreal the No. 1 line is located close to the railway. The conductors on this line consist of seven-strand aluminum cables, having a cross section of 165,000 circular mills. The wires are spaced 60 inches apart in an equilateral triangle. The cross-arms are 6" x 6" pine arms, 6 feet long, which were treated with asphalt before being put up. The standard length of pole is 35 feet and they are placed 5 feet in the ground. The standard length of span on No. 1 line is 100 feet.

The No. 2 transmission line was built two years after the first line, and parallels the Canadian Northern Quebec Railway for the entire distance between

Shawinigan Falls and Montreal. This line is of the same general construction as the No. 1 line, except that the aluminum is of a slightly larger cross-section. The standard length of span on No. 2 line is 130 feet. The length of the transmission lines from the power house at Shawinigan Falls to the terminal station in Montreal is eighty-five miles.

### Sub-stations.

There are at present three substations on the Montreal system between Shawinigan Falls and the terminal station at Montreal. The Joliette substation, located just outside of Joliette, is approximately fifty miles from the power house at Shawinigan. From this station power is carried over a double transmission line to Sorel, located on the south side of the St. Lawrence River, about twenty-five miles from Joliette. The voltage on this branch line is 12,500 volts. The power is carried across the St. Lawrence River by means of two 3-phase, submarine, rubber-covered, armoured cables, which are operated at the line voltage of 12,500 volts. The Joliette station is a good example of modern substation construction, containing 4 225 k.w. oil insulated, self cooled transformers. These transformers reduce the voltage from 50,000 to 12,500. The four transformers are connected in sets of two, so that the two Sorel lines may be operated separately if so desired. Provision has been made in the wiring, however, so that in case of failure of one transformer the remaining three may be operated in delta. For the purpose of supplying power to Joliette, 3 75 k.w. transformers, having a voltage ratio of 12,500 to 2,500 are installed in this station. Shawinigan power is used in Joliette for operating waterworks, a paper mill, stone quarries and for lighting purposes. The business in Joliette is carried on by the municipality, which uses Shawinigan power as an auxiliary to their own power plant, which has been outgrown with the growth of the city.

The second substation is located at Charlemagne, from which point the power is distributed to Charlemagne, St. Paul, L'Assomption, St. Francois, St. Rose, St. Therese and Terrebonne through the intervention of the Laval Electric Company. The distributing system by which power is conveyed to these towns consists of 12,000-volt primary with small sub-stations located in each town, where this voltage is reduced to 2,500 volts for local distribution.

The third substation is located at Longue Pointe, where power is taken off the high tension line for the operation of the Vulcan Portland Cement Works. Power is sold to this company at the high tension voltage, and the substation is owned and operated by the Vulcan Cement Company, Limited. In this station, which consists of a reinforced concrete building, are located three 750 k.w. transformers, which reduce the voltage to 440 volts. In this substation is also located the distributing switchboard from which the various circuits start to different parts of the cement plant.

All of these substations are provided with high tension switches so that each station may be operated from either of the high tension transmission lines. These switches are so arranged that the lines may be paralleled and the substation changed over from one transmission line to the other without interrupting the service supplied to the substation.

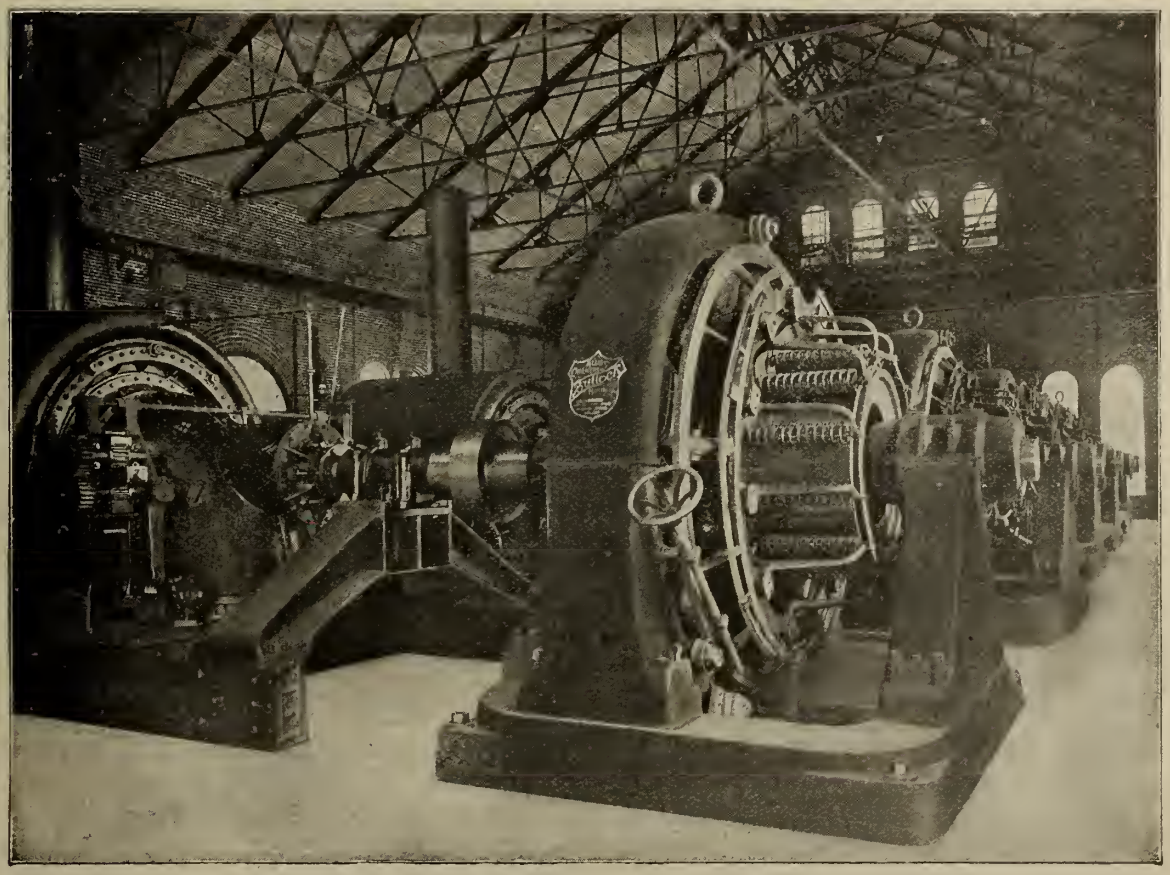


Fig. 6.—Power House of Northern Aluminium Co., Shawinigan Falls, Ont.

### The Montreal Terminal Station.

The terminal station in Montreal is by far the largest and most interesting of the substations of the Shawinigan Company. The building is of brick and steel structure, which is divided into three rooms. Along one side of the building is located the transformer room in which are the step-down trans-

formers reducing the voltage from the high tension line voltage to 2,400 volts. The two transmission lines supply transformers which are located in different compartments so that in case of a serious failure of transformers the apparatus on the other transmission line would not be affected. All of the transformers installed are of the oil insulated, water-cooled type, supplied by the Westinghouse Co.

The centre part of the building is taken up by the machine room, in which are installed the motor generator sets and rotary convertors for converting the power for use in the city. Here 13,000 h.p. is converted by means of motor for the purpose of bringing the machine to synchronous speed. The weight of the rotating parts of this machine is carried on a roller bearing running in oil. This roller bearing was supplied by the Standard Roller Bearing Company, Philadelphia, U.S.A. The rotating parts of this machine weigh approximately 100,000 pounds, and the machine operates at a speed of 450 revolutions per minute.

In one end of the machine room are installed three 900 k.w. 30-cycle, rotary convertors, by which 3,000 h.p. is converted into 60-cycle direct current for street railway service. These were built by Allis-Chalmers-Bullock.

floor of the machine room and so located that switchboard operators have a clear view of all of the machinery in operation in the station.

**Transmission to the Asbestos Region.**

During 1906 a transmission line was built from Shawinigan Falls to Thetford Mines, and neighboring towns, a distance of about 100 miles, covering the territory to the south of Shawinigan Falls on both sides of the St. Lawrence River. Power is taken off of this transmission line at a large number of substations for the purpose of supplying power to various towns and mining districts through which the line

Fig. 7.—Motor Generators in Terminal Station Changing Frequency 30-Cycle to 60-Cycle.

motor generator sets consisting of 30-cycle synchronous motors direct connected to 60-cycle generators. There are installed in this station five 1,000 k.w. Allis-Chalmers-Bullock motor generator sets, and two 4,000 k. w. motor generator sets. These machines, all but one, are of the standard horizontal type. The last machine installed, however, consists of a vertical 4,000 k. w. synchronous frequency changer, the generator delivering 2,300 volt, 60-cycle, 3-phase power. On the top of this machine is installed a 30-cycle induction

The 1,000 k.w. frequency changers in this station are the largest frequency changers in operation. There are installed two 300 k.w. Allis-Chalmers exciter sets which consist of an induction motor driving a direct current generator which operates at 125 volts. The switchboard for this equipment is necessarily complicated, consisting of forty panels. The total length of the switchboard is about 90 feet; this does not include the rotary convertor equipment, which consists of sixteen panels. This switchboard is mounted on a gallery elevated about 12 feet above the

passes. This transmission line runs southeast from Shawinigan Falls along the St. Maurice Valley Railway to a substation located on the north bank of the St. Lawrence River. From this station a short branch delivers power to another substation located at the mill of the Wabasso Cotton Company in Three Rivers, where power is utilized for the operation of this cotton mill. Power is also taken from this substation to a distributing station in Three Rivers for general use in the city.

At the substation located on the bank of the St. Lawrence River transformers

are installed which reduce the voltage to 25,000 volts. The power is conveyed across the river by means of submarine cables operating at this voltage. There are at present installed one 3-conductor cable and four single-conductor cables, rubber insulated and armoured. Owing to the severe ice conditions existing on the St. Lawrence River in the spring of each year, special precautions have been taken to protect these cables from the action of the ice. On the south side of the river the cables enter another substation known as the Doucett's Landing substation, where the voltage is raised to 50,000 volts. From this latter substation the line follows a branch of the Grand Trunk Railway in a southeasterly direction for a distance of about 40 miles, to Victoriaville. Here a substation is located, where power is taken off the line for general lighting and power purposes. The main transmission line branches in two directions at this point.

One branch runs nearly due south along the Grand Trunk Railway nearly to Danville, at which point it leaves the railway and runs five miles across country to a substation located at the mill of the Asbestos & Asbestic Company at Asbestos, P.Q. In this asbestos substation are located three 1,000 k.w. transformers which reduce the voltage to 2,200 volts for use in the neighboring mills of the Asbestos & Asbestic Company. The other branch of the transmission line runs east from Victoriaville across country forty miles to Thetford Mines, where is located a substation from which power is distributed in the town of Thetford Mines to the King's Asbestos Company, the Beaver Asbestos Company, the Thetford Mines Electric Light Company and other smaller consumers. From Thetford Mines the high tension line follows the Quebec Central Railway in a southerly direction to Black Lake, P.Q., where a substation is located from which power is distributed to the British Canadian Asbestos Company and the Black Lake Chrome & Asbestos Company. The high tension line continues past this substation into the mountains to another small substation located at Bellmina, where power is taken off for another asbestos mill. At the present time a branch of the high tension line is under construction from Thetford Mines in a northeasterly direction along the Quebec Central Railway to Robertson and East Broughton, at both of which points substations are being built for the purpose of distributing power to the Robertson Asbestos Company, the Broughton Asbestos Fibre Company and the Frontenac Asbestos Company, and other asbestos industries located in this vicinity. All of the leading asbestos companies are using electric power for operating the mills, driving pumps, air compressors and electric hoists. The newer mills are being built with the especial design of utilizing to the fullest extent the advantages which can be derived from the use of electric power. This means that a large quantity of belting, shafts, etc., are rendered unnecessary, and great gains are made in the economical use of power.

About 6,000 h.p. is now being utilized from the Shawinigan lines, and this amount is being rapidly increased. When it is considered that over 80 per cent. of the amount of asbestos produced in the world comes from this mining district, and taking into account the varied and rapidly growing uses that are being found for asbestos, it can easily be foreseen that this field is a very promising one for the use of power.

---

# Some Considerations of Heat and Cold Insulation*

## Suggestions in Regard to the Insulation of Steam Pipes, Etc., With a Brief Review of the Properties and Laws of Heat.

By O. A. COLE.

In the consideration of heat and cold insulation, we will arrive at a clearer understanding of the subject, if we first look for a moment at some of the properties and laws of heat; in fact, the very nature of heat itself.

It was at one time believed that heat was a mysterious, invisible fluid, which had the power of passing from one part of a body to another part, or from one body to another body, very much like water saturates a sponge.

The modern and scientific theory of heat is called the kinetic or molecular theory, which assumes that all matter is composed of molecules or invisible particles, which are constantly in motion among themselves. As the velocity of their movements is increased, the temperature of a substance is increased, and likewise, when their motion is slight, the body is cold. It is assumed that the molecules of some materials are more easily moved than others, which would account for the fact that some substances are more easily heated than others. When the molecules of a substance are moving relatively slow, we call the matter a solid, and if more heat is applied, the molecules move faster and over greater space, the solid becomes a liquid, and with still more heat and greater molecular action, the liquid becomes a gas. All this is simply changes in state which heat produces. Familiar examples being transforming of ice into water, and water into steam, or the melting of iron into a liquid and this liquid transformed into gasses.

We will not consider the various causes of heat, such as friction, pressure, the sun and chemical action any further than to remark that heat for commercial purposes is usually derived from chemical action or the combustion of fuel. This fuel costs money, and hence, any means by which heat and its power are preserved means smaller coal bills and greater efficiency from boiler room to machine.

In this brief review, we are concerned with three principal means by which heat is transmitted, i.e., conduction, radiation, convection.

Conduction is the power by which heat is transmitted from one part of a body to another part. A simple example will illustrate. If one end of a metal bar is heated in the fire, the other end will after a time become hot. The motion imparted to the particles of metal by the hot coals, passes along to adjoining particles, etc. This is conduction, and is the way in which solids become heated.

Convection is the manner in which heat is transmitted into liquids and gasses, which are usually in themselves poor conductors. They expand easily however, and as heat enters and expands the gasses or liquids, these expanded portions rise, and gravitation places heavier portions in their places, which are in turn heated and expanded, thus setting up currents which carry heat to greater distances.

Radiation is the passing of heat from one body to another, as from a hot iron to the atmosphere. It is important to remember that heat always has a tendency to flow from high temperatures to lower or from a hot body to a colder. There is an unceasing effort to equalize temperature.

### Conduction.

Now we have noted these three forms of heat transmission, let us return for a further consideration of conduction.

As a general rule metals are good conductors, while glass, rock and similar substances are poor conductors, and wood, fibrous rock, wool and gasses are the poorest conductors. This is a very fortunate arrangement, because if all materials conducted heated equally well there would be no problem of insulation. A few examples of the differ-

*Paper read before the Toronto Lodge, C.A.S.E.

ences in powers of conduction of heat are instructive.

Copper conducts 96 heat units, while iron conducts 2, or, copper is 48 times as good a conductor of heat as iron.

Sandstone conducts heat only 1-40 as fast as iron.

Asbestos Rock conducts heat only 1-75 as fast as iron.

Oak Wood conducts heat only 1-400 as fast as iron.

Air conducts heat only 1-5000 as fast as iron.

Cotton Wool conducts heat only 1-2000 as fast as iron.

Gray Paper, unsized conducts heat only 22-100,000 as fast as iron.

Cork conducts heat only 1-200,000 as fast as iron.

Many more examples might be given but these will suffice to show that there is a great difference in the conductivity of different materials.

Hence, you see that the problem of heat and cold insulation is simply a question of arranging poor conductors around the heat you wish to confine.

Conveyances of steam and hot gases are of necessity made of some kind of metal which we have already noted is always a good heat conductor.

Now, we have noted that cork, cotton wool, wood, etc., are among the hardest substances for heat to get through, but there are other things to consider. If we are to insulate a high pressure boiler or high pressure steam connection or smoke breeching, these classes of materials are not in themselves proof against the fire. They char readily and tend to disintegrate.

The next best insulator is air, and it is of course fire proof, but it is readily heated by convection. Hence, air alone cannot be used. Air, to be of any use in insulation must be confined and the smaller the spaces into which it is divided and absolutely confined the better. The reason is obvious. If air has a large space little convection currents are easily set up and the whole mass rises in temperature and transmits heat to the walls which contain it. On the other hand, when the spaces are infinitely small, say like the space between the grains of Talcum Powder, convection processes are not developed; the air remains perfectly stationary, and the real insulating and non-conducting powers of it are utilized.

Naturally then, the question confronting the engineer is, what kind of materials to use as air retainers. He wants for this as good a non-conductor as possible and on live steam it must be fire-proof; it must be able to stand for a number of years, and must not be too costly. With the growth of steam power has developed the necessity of securing dry steam for best and safest results, and therefore, many forms of insulation have been devised and improved upon from time to time.

The problem before the manufacturers of insulating materials to-day, is to produce articles that will bring best results in proportion to the amount of money the engineer has at his disposal. Much thought has been given the matter and many different insulators have been put on the market. As a rule, the engineers of this generation have a wide range of insulating materials to select from.

A word in regard to the value of insulating heated surfaces will, no doubt, be valuable, as there are a few engineers who have no conception of the amount of heat that is lost by radiation from uncovered pipes and boilers.

Quoting from Prof. C. P. Gibson, of Philadelphia, who has conducted many tests :—He says, that the waste or loss in fuel alone from uncovered pipes, amounts to $64.50 per annum for every 100 feet of uncovered pipe, coal being estimated at $4.00 per ton. This estimate is based on the average sized pipe, while larger pipes lose more in proportion, of course, and smaller pipes less. When you consider this loss, together with the saving that can be made by having the surfaces covered, and in addition, dry steam for your engine cylinders and the absence of accidents and break downs, it is a subject worthy of thought.

Another example taken from Volume 23, of the transactions of the American Society of Mechanical Engineers. Tests were made on 100 lineal feet of 2" pipe, carrying steam at 80 pounds pressure. They calculated the loss on a plant working 300 days at 10 hours per day, with a temperature of engine room at 65 degrees. Their calculation was based on one pound of coal evaporating 11 pounds of water, and it was found that with coal valued at $4.00 per ton, they lost $31.04, or about 52c. per square foot every year.

Another example taken from the same volume and the society. On 100 lineal feet of 2" pipe, carrying steam at 150 pounds pressure, showed a net loss of $39.48 per year, or about 62 cents per square foot.

The price of the fuel does not matter materially. For example, a large coal concern in Pennsylvania were operating a battery of 17 boilers. The president of this company was interviewed in regard to covering the boilers and pipes, but he argued that there could be no economy in doing so because their coal only cost them about 40c. per ton or something like $7.00 a car. He was induced however, to allow covering to be applied to the tops of the boilers and domes and steam pipes; and when this was done, 13 boilers operated the plant easier than the original 17. They knocked off a battery of 4 boilers and then saved a carload of coal a day, besides the wear and tear on the boilers, wages of the stokers and incidental expenses. Needless to say, the president was convinced that it was economy to cover the heated surfaces.

This establishes beyond question all doubt that uncovered boilers and pipes are a continual source of loss in actual money, and a menace to the entire plant, because there is a danger of accidents.

**Forms of Insulation.**

Among the first forms of insulations for boilers and live steam pipes was a Plastic Cement, made from plaster and lime, or gypsum, or talc, or other substances, mixed with more or less of asbestos fibre. Its composition varied greatly with different manufacturers. This same material was moulded into sections for pipes and blocks for larger surfaces and a great many different kinds of this same sort of material is used to-day. It is not expensive, although, its non-conducting powers are limited, because it is too nearly solid. It contains practically no air spaces, because it is a cement structure and depends upon this cement to hold it together. However, since its cost is small, it is not a worthless material, even on high pressure work, and probably pays for itself in time, while on low pressure and hot water surfaces, it is more economical, and does the work of insulation very well. Severe exposure and treatment such as, vibrating of pipes is liable to injure it in time, especially on vertical pipes.

Another insulation composed of Mineral Wool, encased in Asbestos Paper and rosin-sized paper is another old form of heat insulation. In some sections this covering is still in general use on high and low pressure lines. Its structure varies with different manufacturers. If it is not carefully made it disintegrates very readily, but so long as a uniform thickness remains on the surface it gives good results. Inferior grades of iron slag mineral wool, placed directly on metal surfaces, have been known to corrode the metal and cause serious results. This is due to the presence of certain chlorides which attack the iron.

Within the past 20 years a large number of different makes of pipe and boiler coverings for high and low pressure work have been put on the market. Time will not permit a complete description of all these. There is one kind however, which is manufactured by a number of different firms known as, 85 per cent. magnesia, which deserves special mention.

**Magnesia Covering.**

It is composed of 15 per cent. pure asbestos fibre and 85 per cent. carbon-

ate of magnesia. Magnesia carbonate is made from dolomite rock in the following manner:—The rock is quarried and burned like limestone for lime. It is then slacked and mixed with water and charged with carbonic acid gas. This produces two chemical compounds, a calcium carbonate in the form of a precipitation of powder, and magnesia bicarbonate in the form of a liquid. Calcium carbonate is filtered out of the magnesia bicarbonate, and the latter passes off into tanks, where it is boiled, and the white magnesia powder is precipitated. This is the pure magnesia carbonate. It is then carried in water to the large tank where asbestos fibre is added and thoroughly mixed, and from thence it is passed into hydraulic pressed moulds, which form the sectional and block covering. These sections and blocks are then dried and milled ready for use. Note especially, that this material is pressed into shape by hydraulic pressure. It does not depend upon a cement composition to hold it together. The asbestos fibre is put in for a binder, and since asbestos is very adhesive, it accomplishes the work in a marvellous way. There are an infinite oumber of minute air spaces between the grains of magnesia powder, which act as insulators. The non-conducting power of magnesia powder itself is very great, but when combined with dead air spaces, the resulting material proves a very valuable insulation. For high pressure boilers and pipes and superheated steam pipes this covering is so far without an equal, as is proven by its general adoption by large corporations and power plants.

As a general rule this covering is made in standard thicknesses for steam pipes, ranging from 1" thick up to 1½" thick on up to 12" pipe. It is also made, however, in special thicknesses such as 1½", 2", 2½" and 3" thick. The efficiency of the covering is greatly increased with the thickness.

Scientific tests have been made from time to time, but perhaps one of the most exacting was that of the Manhattan Elevated Railway Co., New York City. At the time they changed their lines from steam to electric, they were interested in securing a large quantity of insulation. Various manufacturers presented their claims for their pipe and boiler covering, and they decided to make a test. They put the matter in the hands of Prof. H. H. Stott, who made careful preparations for the tests, and all manufacturers were invited to supply and instal the various grades of their covering for testing. A special vault was used and several days were consumed in making the test. The result was that 85 per cent. magnesia covering showed much less heat loss than any of the other kinds of covering except cork, which saved 4 per cent. more heat, and carbonized silk, 3 per cent. As the latter two were not fireproof, however, they were not considered in placing their contract.

In 1896 the American Society of Mechanical Engineers conducted a test at Syracuse, between 85 per cent. magnesia and a covering composed of all asbestos fibre. Sixty feet of 8" pipe was used and the steam pressure was about 115 pounds. Magnesia saved about 4½ per cent. more heat, or $5.59 more per year than the other covering. The cost of the magnesia covering was $33.87 applied, and the other covering $31.80 applied. Hence, magnesia would save over and above the other enough heat in 4½ years to pay for the cost of magnesia and would, therefore, be more profitable than if the inferior covering had been applied free of charge.

### Other Efficient Insulators.

There are numerous less expensive coverings which are very efficient insulators. A covering composed of alternate layers of wool, felt and asbestos paper is a close second to 85 per cent magnesia; and the common asbestos air cell covering in 1" and 1½" thicknesses is frequently used on high pressure lines with remarkable results.

The proper application of coverings is often overlooked. If we again refer to the Manhattan test we find that the magnesia test rings that were applied evenly, having closed joints, tested in some cases 2 per cent. better; while the broken joint method of application was by far the best. By broken joint method is meant the application of two thin sections instead of the same thickness in one section.

In covering boilers, smoke breechings, separators, etc., the efficiency of any insulation is greatly increased if it is applied over about an inch of dead air space. Furing strips of iron and wire cloth is used to make this air space. The covering is then placed on the wire cloth in the regular way.

### Cold Insulation.

Leaving the discussion of low pressure and hot water coverings for consideration later, let us now turn to cold insulation.

We find here, too, that confined air is just as valuable as in heat insulation. It is not so essential that we use fire-proof materials, however, but it is absolutely necessary to have them waterproof, because if water gets near a brine or ammonia pipe, it freezes and the expansion of same will burst any kind of material.

It is a pretty general rule that a poor conductor of heat is likewise a poor conductor of cold. But, on refrigeration lines, if the conductor is not practically air-tight, convection currents will pass through the insulator and deposit moisture from the atmosphere.

It has only been within recent years that really satisfactory cold insulators have been made.

The old method of applying hair felt and 2 or 3 shells of tarred felt is fast going out of use, because its life is too short, and under poor workmanship it does little good.

Various coverings for making dead air spaces next to the pipe have been advocated, but the most satisfactory material to-day is cork. We have already noted that cork is a better non conductor than even confined air, and therefore, cork as an insulation performs its work purely upon its non-conductive properties rather than so much upon its confinement of any great amount of dead air.

A means has been discovered whereby cork is now made absolutely impervious to water, and it therefore seems to have answered completely the problem of cold insulation. For refrigeration pipes and codlers, thicknesses from 2½" to 3½" are used, while for ice water and beer pipes about 1½" thick is all that is necessary. Sweat pipes only need about 1" of cork.

Among the cheaper coverings for cold water pipes, a wool felt with a tar paper lining is very satisfactory.

In conclusion, gentlemen, you will notice that I have not dwelt strongly on the cheaper forms of heat and cold coverings. It certainly should be the policy of every engineer to seek those coverings which will give him the best results. If you have a temporary plant, requiring covering for but one year, a cheaper grade would be the best investment, but if your plant is to run 10 years or more, it is a waste of money to buy anything but the covering which will save you the most heat.

I hope that these suggestions and facts given to-night will prove to be useful to the engineer who is confronted with the problem of insulation, and enable you to convince your superiors that to spend a few dollars extra at the start will save many hundred per cent. of the amount in 10 years.

---

## QUEBEC BRANCH C.S.C.E.

The annual meeting of the Quebec branch of the Canadian Society of Civil Engineers was held at Quebec, January 15th. The officers elected for the current year are: L. A. Vallee, chairman; Hugh O'Donnell, secretary-treasurer; Messrs. Boswell, Decary and Leofred, members of the executive committee, and E. A. Hoare, ex-officio member of the executive committee.

# Course of Lessons for the Instruction of Stationary Engineers

## Third of the Series—These Articles Take up in a Simple Manner Steam, Gas and Electrical Engineering, and are both Interesting and Instructive—This one Deals with Thermo-Dynamics.

By W. A. CROCKETT.

Thermo-dynamics is the science which treats of the relation between heat and work. The experiments of Rumford & Davy at the end of the 18th century demonstrated a definite relationship between heat and mechanical energy. In 1843 Joule published his experimental determination of the mechanical equivalent of heat, i.e., the amount of mechanical energy which is equivalent to a given amount of heat. He found that 772 foot-pounds of work were required to raise the temperature of 1 lb. of water one degree fahrenheit. Subsequent experiments have shown 774 to be a more eorrect value. *Carnot introduced the idea of a cyele of operations, in which the working substance, after having experienced a certain number of transformations, returns to its original state as to density, temperature, and physical condition. He also considered the special properties of a reversible cyele. In 1848 Lord Kelvin, Clausius and Rankin developed the modern theory of thermo-dynamics.

First Law.—When mechanical energy is produced from heat for each unit of work produeed a definite quantity of heat is absorbed ; and conversely if heat be produced by the expenditure of mechanical energy a definite quantity of heat is produeed by the expenditure of a given amount of work.

Second Law.—It is impossible to convey to heat from one body to another body at a higher temperature by the agency of a purely self-acting machine (Clausius). This law limits the possible thermal efficiency of any heat engine, the efficiency which is given by the ratio

$$\frac{\text{heat turned into work}}{\text{heat taken in by the engine}}$$

being always very much less than unity even in a perfect engine. In all engines for transforming heat into work the transformation is effected by changes in volume of the working substance. We can represent the changes taking place in the working substance by Watt's indicator diagram shown in the illustration. If the substance expand from ai to volume el, the work performed by it is represented by the area abche ; if compressed from volume cl to volume ai, the work done upon it is represented by adche ; and therefore the work done in a complete cycle is represented by the area abcd.

### Carnot's Cycle.

Suppose we have a piston working without friction in a cylinder, the walls of which are perfectly non-conducting, but the bottom of which is a perfect conducter and provided with a non-conducting cover C. Suppose also that we have a hot body A capable of supplying an unlimited amount of heat at a temperature T1 and a body B capable of absorbing any required amount of heat at a temperature T2 lower than T1. Let the cylinder contain a quantity of the working substance at temperature T1 and let the volume Va be represented by ai.

The cycle is divided into four operations, as follows : (1). Apply the source of heat A to the bottom of the cylinder. The working substance will expand isothermally at temperature T1 to a volume Vb, the piston rising and doing external work. This is represented on the indicator diagram by the expansion curve ab. (2). Remove A and apply the cover C, allowing the working substanee to do work on the piston in expanding to a volume Vc. The expansion will be adiabatic, i.e., without gain or loss of heat, and the temperature will fall. Suppose that at volume Ve the temperature is T-2. (3). Remove C and apply B, the piston at the same time being pressed down. The working substance will be compressed isothermally at temperature T-2, to a volume Vd to be determined by the condition to be fulfilled in operation. (4). Remove B and apply C, and let the compression be continued. The working substance will be compressed adiabatically, and its temperature will rise. Suppose that in operation (3) the point D has been so ehosen that when the working substance is compressed to the original volume Va, the temperature has just risen to T1.

The heat in this cycle of operations is supplied at a constant temperature T1, and rejected at a constant temperature T-2 ; also the working substanee passes through a complete eyele, returning to its original condition as regards pressure, volume, and temperature. It is evident that each step in the above cycle might be gone through in the reverse direction. An engine in which this is possible is said to be "reversible." Carnot showed that a reversible heat engine is a perfect heat engine, in the sense that no other heat engine working between the same limits of temperature can possibly have a higher efficiency.

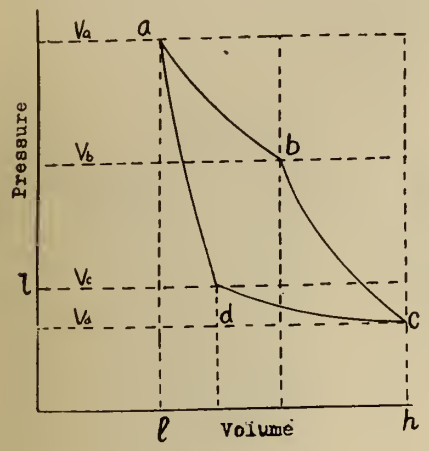
Suppose we have two heat engines A and B of equal powers, B being reversible ; and let A drive B in the reverse direction. Let Qa be the heat taken from the source by A per unit of work done, and Qb the amount returned to the source by B. Let Ra be the heat returned to the cold body by A, and Rb the heat taken from the cold body B. Suppose that A is more efficient than B. Then an amount of heat Qb—Qa will be given to the hot body and an amount Rb—Ra minus taken from the cold body. Since A is more efficient than B, Qa will be less than Qb. Also, since the power is the same in each ease, Qa—Ra plus Qb—Rb or Qb—Qa plus Rb—Ra, i.e., an amount of heat Rb—Ra has been taken from a eold body and given to a hot body by means of a self-acting contrivance, which is contrary to the second law of thermo-dynamics. We conclude, therefore, that no engine A can be more efficient than a reversible engine B working between the same limits of temperature. If we now suppose A to be reversible, similar reasonings shows that B cannot be more efficient than A, and hence all reversible heat engines working between the same limits of temperature are equally effieient. As will be shown, the efficieney in the case of an engine working with a perfect gas is given by T1-T2, where T1 and T2 are the absolute temperatures at which heat is received and rejected respectively ; and since all reversible engines are equally efficient, the above expression must be a measure of that efficiency. The above reasoning shows that reversibility (in the thermo-dynamic sense) is the condition for maximum efficiency in a heat engine, but that what may be called a perfect heat engine can only convert a fraction of the heat supplied into work, the fraction depending on the limits of temperature between which the engine works, but not at all on the nature of the working substance employed. Gases which liquify with diffi-

* Professor Rowland has found a B. T. U. to be equivalent to the work of raising 778 lbs. one foot high or one pound 778 feet high. 778 foot pounds is designated by the letter J from (Joule) (also known as the mechanical equivalent of heat) I divided by 778 is designated by the letter A and termed the reciprocal of J.

culty, such as air follow certain laws and we speak of an ideal substance which follows these laws exactly as a perfect gas.

**Boyle's Law.**

Boyle's law of a perfect gas : The pressure of a portion of gas at a constant temperature varies inversely as




Indicator Diagram.

the space it occupies. If P be the pressure and V the volume of a given mass of gas, then PV—constant. The following example shows the application of Boyle's law. Back pressure 4 lbs., steam pressure 30 lbs., clearance $\frac{1}{2}$ inch. How far must piston be from end of stroke at compression to compress the enclosed vapour in eylinder, so that the pressure shall rise to that of the steam in the steam-ehest. In the clearance space the steam has a volume of $\frac{1}{2}$ ineh at 30 lbs. pressure. The back pressure has to increase from 4 lbs. to 30 lbs., therefore the volume has to deerease from 30 to 4, or 2-15. At compression the steam occupies 30-4 of $\frac{1}{2}$—2 $\frac{3}{4}$ inches. From $3\frac{3}{4}$ inches deduet the amount of clearance, $\frac{1}{2}$ inch and we get $3\frac{1}{4}$ inches as the distance the piston is from the end of stroke where compression began.

Joule's Law—If a gas expand without doing external work, its temperature remains the same.

Regnault's Law—The speeific heat at constant pressure is constant for any gas.

An intimate knowledge of teehnical terms is indispensable to the engineer ; some of them are briefly defined.

**Units of Measurement.**

Linear unit is the inch or 1-12 part of a foot.

Superfieial is the square inch.

Solid is the cubic inch.

Unit of fluid pressure is the pound avoirdupois eonsisting of 7,000 grs.

Unit of Elastieity, or the pressure exerted by elastic fluids, is one pound on one square inch.

Unit of energy work or power, is one pound raised 12 inches, i.e. one pound of force acting through one foot of distance and is called the foot pound.

**Horse Power.**

The standard used for measuring the power of a steam engine is the horse-power (H.P.) The measurement of a horse's power of work first ascertained by Watt the inventor of the steam engine was founded upon the basis that the average brewery horse was eapable of doing work equal to that required to raise 300 lbs. of weight 100 ft. in one minute, or 33,000 lbs. one foot in one minute. This estimate however was for one minute. It would not be possible for a horse to perform this amount of work continously for eight conseeutive hours. One horse could exhaust 12 men in a single day, for where a strong man could perhaps pull half of 330 lb. to a height of 100 feet in two minutes, he could not repeat the operation more than a few times. A man's power is about 1-10 of a horse's power. That is, when a horse could pull 330 lbs. to a height of 100 feet, one minute and then slaek up and repeat the operation, for eight hours, thus pulling four hours, and slacking up four hours, but it would require ten strong men to perform the same amount in that length of time. When man put horses to work the gain in labor for the world was thus ten-fold. Multiply this by steam power, waterpower, air-power and above all, electrie power, and one has a problem in mechanical progression. I.H.P. (Indieated horsepower) is the H.P. of an engine as found by the use of a steam engine indicator.

Net horse-power is the indicated horse power of an engine less the horse-power whieh is eonsumed in overcoming its own friction.

Wire drawing as applied to steam is the reducing of its pressure, due to its flowing through restrieted or crooked pipes or passages. Absolute pressure is the pressure of any fluid as shown by a pressure gauge plus the atmospheric pressure whieh at the sea-level is 14.7 lbs. per square inch. For very rough calculations 15 lbs. is assumed.

Initial forward pressure in a eylinder is the pressure acting on the piston at or near the beginning of the forward stroke. Terminal forward pressure is the pressure above the line of perfeet vacuum that would exist at the end of the stroke if the steam had not been released earlier. It is always measured from the line of perfect vaeuum, hence it is the absolute terminal pressure.

M.E.P. (mean effeetive pressure), is the average of all steam pressure which acts on one side of the piston to move it forward less all the steam pressure which acts on the other side of the piston to retard it. Piston displacement is the space in the eylinder swept through by the piston in its travel. It is reckoned in cubic ineches, and is found by multiplying the net area of the piston in inches by the length of stroke in inches, allowance being made for the piston rod.

Clearance is the space between the ends of the cylinder and the piston when the latter is at the end of its stroke i.e. when on a dead center, together with the volume of the steam-port and eounterbore up to the face of the closed valves.

Sensible heat is the temperature of any body as air water, or steam, measured by the thermometer.

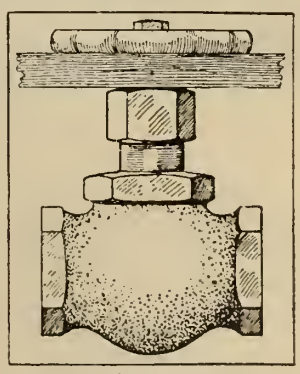
Entropy is a quantity relating to a body such that its increase or diminution implies that heat has entered or left the body. The amount of heat which enters or leaves the body is measured by the product of the increase or diminution of entropy into the temperature at which it takes place. Heat energy is available for doing useful external work only when the source of heat utilized is hotter than surrounding bodies i.e., when the heat is transferred from a hotter to a colder body.—When all bodies have the same temperature they ean do no more external work. In the various transformations of energy some of the energy is eonverted into heat, and this heat is gradually diffused through the universe and thus becomes non-available to man. Therefore the entropy of our earth is deereasing. From the definition of entropy it follows that during adiabatie expansion the entropy will remain constant since no heat is either received or rejected.

The fourth lesson will deal with other definitions and further data in eonnection with the thermo-dynamics of the steam engine.

---

## TURNING A DAMAGED PACKING NUT.

When a packing nut on a globe valve becomes damaged so that the threads will not follow their course, place a piece of wood between the hand wheel



Repairing Valve.

and the nut, as shown in the sketch, and turn both at once. This will greatly assist in turning the nut down to its proper place.

# Complete Line of Belt and Steam Driven Air Compressors

## Line of Air Compressors as Built by the Thos. H. Dallett Co., Philadelphia, Bring Out Many Excellent and Unique Ideas in Compressor Design.

These compressors incorporate the essential features of having all parts requiring adjustment or renewals readily accessible, and using a liberal amount of metal, to insure rigidity in operation.

The frame is of the Open Fork center crank type, and designed to obtain on each size compressor a greater range of capacity by substituting, when desired, a cylinder of the next larger size than the standard to operate at 100 lbs. pressure. For example :— On an 8" stroke compressor, the regular cylinder for 100 lbs. pressure is 8" in diameter, but a 10" diameter cylinder can be substituted and still operate at the above pressure, whereby a greater volume of air is obtained with but a slight increase in cost of machine.

The cross head guides are cylindrical and are bored at the same setting as the boring and facing of the end which receives the cylinder, insuring absolute alignment. Lubrication is effected by means of sight feed devices, or by gravity or force feed system, as desired, and drains are provided for draining off all drippings from guides, stuffing boxes and crank pit.

The duplex belt, duplex steam and single steam machines are supported on a rigid and deep sub-base, thus making the entire machine self-contained and insuring satisfactory operation on either a rough temporary foundation of timbers, or a permanent one of concrete or brick. An oil gutter is provided entirely around the lower base flange on all sub-bases.

The steam cylinder and valve gear of the steam driven machines are examples of up-to-date steam engine practice, giving high efficiency. All steam ports are short and direct and of the proper area. The clearance has been reduced to a minimum, giving an appreciable saving in steam consumption. A plain D balanced slide valve is used on the small and medium sized machines ; the Meyer balanced adjustable cut-off valve being employed on the larger machines. To provide efficient heat insulation, all steam cylinders are lagged with mineral wool and neatly jacketed with planished sheet steel.

The rocker arms on all valve gears are provided with means for adjustment. On every steam driven machine the governor is equipped with a safety stop device, which immediately stops the machine in case the governor belt should break.

The governor pulley is situated on the end of the shaft outside of the fly wheel on the single steam machines, thus bringing the fly wheel as close to the bearing as possible in accordance with the best construction, and also eliminating all possibility of oil or grease from the eccentric getting on the governor belt.

In the case of duplex compressors with compound steam cylinders, a difficulty has been, if the machine stops with the high pressure side on the dead center, which occurs frequently, it will not start automatically, this being due to the fact that but one side (the high pressure) takes steam from the line. This trouble has been overcome by using a reducing valve of standard make, which reduces the live steam pressure for use in the low pressure cylinder, thus if the high pressure side stops on the dead center, live steam is fed to the low pressure cylinder through the reducing valve, starting the compressor. It is obvious that steam from the boiler is taken into the low pressure side only when starting, otherwise the operation is identical with any compound machine.

The air and steam cylinders are tied together and held in position by means of an internally flanged tie or distance piece. On the smaller sizes this piece supports the air cylinder, but on the larger sizes the air cylinder is supported on a pedestal, while the tie piece is

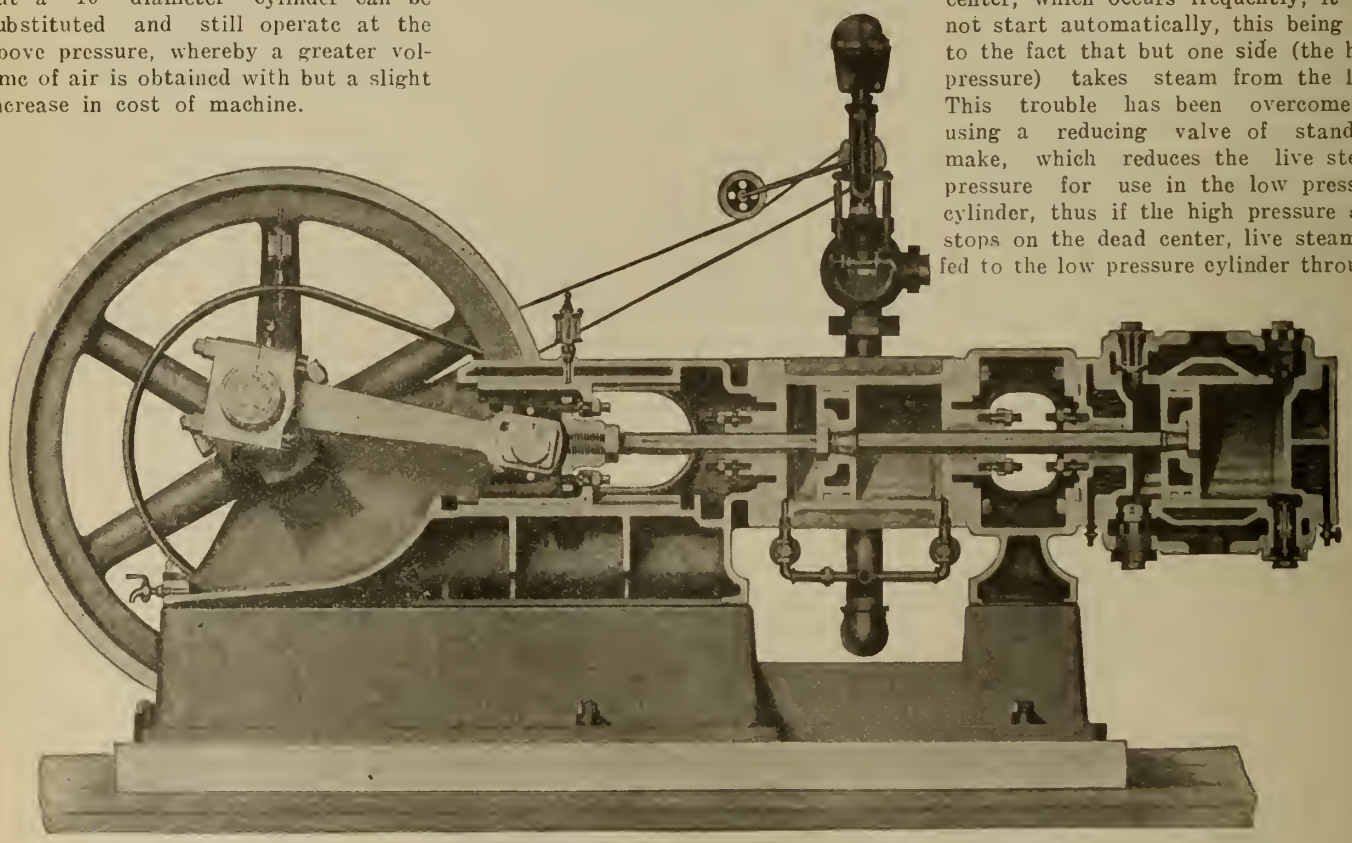


Fig. 1.—Sectional Elevation of Single Steam Machine.

of circular design without the foot piece. Ample openings are provided on each side of the tie piece to allow adjustment of the stuffing boxes and tightening the cylinder stud bolts.

The air cylinders are of a special hard close grained iron, and allowance is made for reboring if necessary. Each cylinder is thoroughly tested before assembling under hydraulic pressure of 200 lbs. All heads and cylinder walls

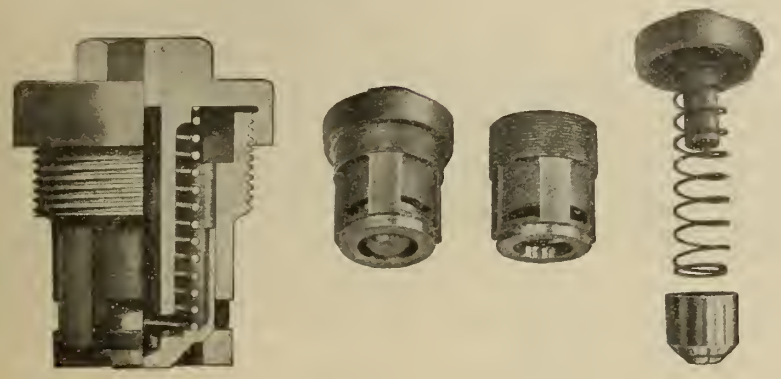


Fig. 2.—Air Discharge Valve and Parts.

are water jacketed, thus obtaining the highest efficiency possible.

Mechanically operated inlet valves are supplied on any size compressure desired. These valves are ground to gauge and the valve holes lapped to size. Any of the standard low pressure compressors are suitable for vacuum service, and are furnished with mechanically operated inlet valves for a high vacuum.

The piston rod on both belt and steam machines is designed to allow for re-turning in case of wear. In re-turning a rod, allowance has been made in size to leave the threads untouched, only necessitating the turning of the straight diameter of the rod.

The cross head is a new type box pattern, made of semi-steel. Its shoes are adjustable and of large bearing surface. The upper shoe is lubricated by means of a sight feed lubricator, and the lower shoe runs continually in a bath of oil. One of the features of this design is the side openings, which allow easy access to the cross head shoe binder bolts. The cross head pin is tool steel, hardened and ground. It is fitted to tapered seats in the cross head, drawn tight on the tapers by means of a nut held in position by a pin. Means are provided for turning one-quarter revolution in case it wears flat on the two bearing sides, thus doubling the wearing capacity.

The intake valve is of the automatic poppet type, contained in a malleable iron cage. The cage is one piece and combines both seat for the valve and guide for the valve stem. The cage is threaded and screws into the wall of the air intake chamber only, and is simply seated in a recess on the main cylinder wall, using corrugated copper gaskets to secure a tight joint. A hexagonal recess has been cast in all cages to accommodate a special cast steel wrench for use in removing and replacing valve cages.

The valve cage cap acts as a lock nut for holding the cage in place after it has been screwed down on its seat in the cylinder. It is provided with a hexagonal projection and the same wrench can be used here as on the valve cages. In the case of a compound machine, corrugated copper gaskets are placed under the valve cage caps on the high pressure cylinder to insure against any leakage, as the discharge pressure from the low pressure cylinder is constantly at these joints.

The valve proper is a special alloy hardened steel, with seat and stem ground to gauge. The valve spring is of phosphor bronze and of the right proportion to give the valve an easy opening and a quick closure.

Fig. 3.—Air Inlet, Valve and Parts.

On the "Dallett" valve, the spring holder comprises a split taper ring set into a recess on the valve stem, and held together and tight to the stem by means of a solid taper ring slipping down over it. The hammering of the valve on its seat tends to tighten the spring holder on the stem due to the action of the taper.

The discharge valve is of the automatic poppet type contained in a valve cage of malleable iron. The method of seating in the cylinder and locking to its seat is identical with that of the intake valve. A projection or boss has been provided on the valve cap, which acts as a positive stop for the valve when it has reached a lift, giving a full opening area, and does away with fluttering. This same projection on the cap also acts as a spring guide for the valve spring.

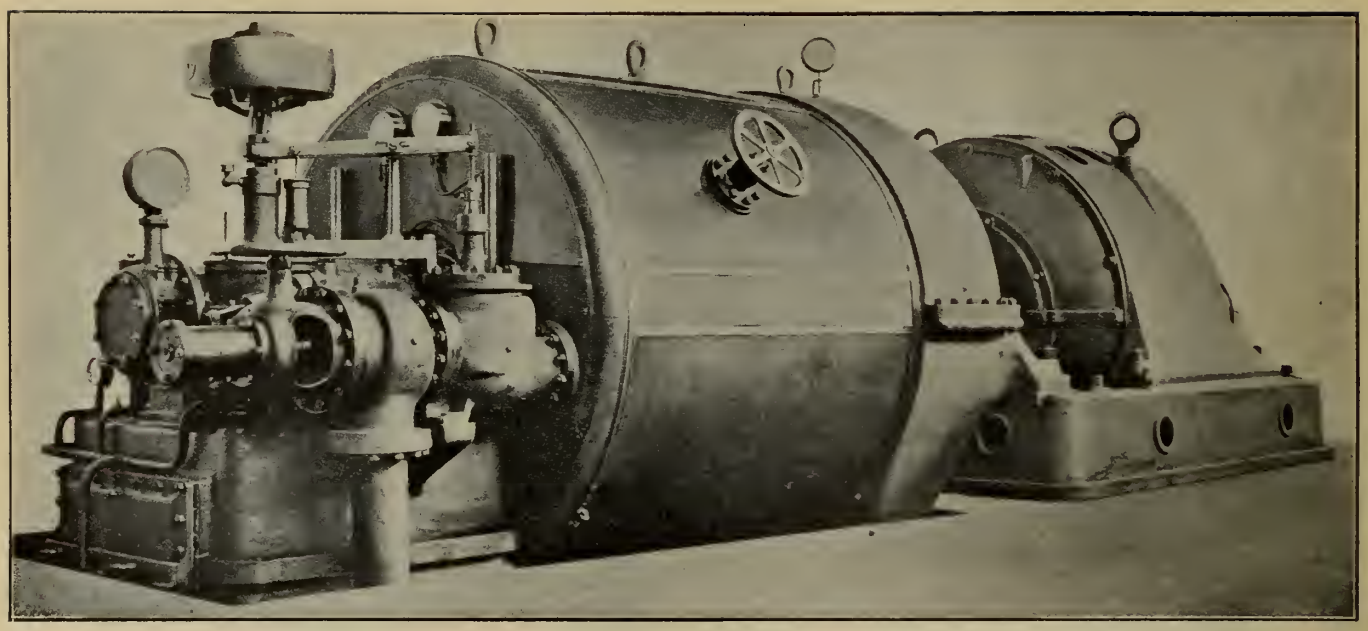
The discharge valve, is of the same material as the intake, having all wearing surfaces ground to gauge.

The inter-cooler plays a very important part in economical operation of a two stage machine. The "Dallett" inter-cooler employs the return flow type of water circulation, using baffle plates to deflect the flow of air and aid in its effectual contact with the cooling tubes. This method is very efficient in reducing the temperature of air between stages to approximately the original temperature, thus tending to reduce the final or discharge temperature and also the horse power required for a given capacity. The nest of cooling tubes may be removed intact from the inter-cooler box without disturbing any of the piping, as unions are supplied to obviate this feature. The inter-cooler is supplied with a pop safety valve, pressure gauge and drain valve.

The belt driven machines are provided with an unloading device which automatically unloads the air cylinder. When a certain determined pressure is reached in the air receiver, one or more inlet valves at both ends of the air cylinder are held open and the load is taken off the compressor, allowing it to run light until the pressure drops in the receiver, upon which the valves are released and air compression is resumed.

On the steam machines a combined speed and pressure governor is used. This governor unloads the air cylinder exactly the same as on a belt driven machine, and at the same time it controls the speed, allowing a single steam machine to just turn over when unloaded, and bringing a duplex or compound machine to a dead stop.

The compressors described are built in sizes from 8" stroke up to and including 16" stroke, and give a range of capacity from 79 cu. ft. of free air per minute to 1200 cu. ft.

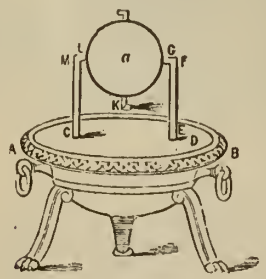


Zoelly Turbine Direct Connected to Alternator, 1250 B.H.P., 1500 R.P.M.

# The History and Development of the Steam Turbine

## Brief Account of Earlier Types, Their Characteristics, Etc.—General Description of One of the Latest Types of Impulse Turbines,

In classifying turbines there are, generally speaking, only two types—those under the head of reaction turbines and the others, impulse turbines. In the former the steam is partially expanded within the rotating element. In impulse turbines the steam is expanded in the guides or nozzles only, where the whole of the potential energy in the steam is transformed into kinetic energy and transmits the movement to the rotor though impulse. The pressure undergoes no change within the revolving part. This fact is claimed as one of the advan-




Hero's Steam Engine.

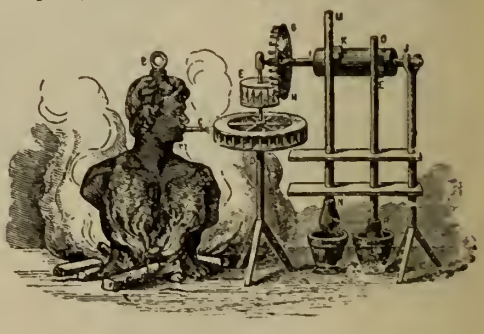
tages of an impulse turbine over one of the reaction type on account of its allowing the use of greater clearances between the rotating and stationary parts than is practical in a reaction turbine. In the latter a difference of pressure exists on the two sides of the rotator, necessitating finer clearances and sometimes a heavy axial thrust on the shaft.

### Reaction Turbines.

It is a far cry back to the first authentic steam turbine and it hardly seems credible that more than 2,000 years have passed since the first machine of this type (that we have record of), was made. It was in 130 B.C. that the Hero engine was built. This was probably used more as a toy or amusement than for useful work. It consisted of a hollow ball having two pipes emerging radially at opposite ends of a diameter. These pipes were turned through a right angle at their ends. The ball was hung on an axis consisting of another pipe connected to the source of steam. A rotating motion was imparted to the ball by the reaction from the emergence of the steam from the radial pipes. Strange to say, we have no record of any further development until we come to our own times, with the exception, perhaps, of an arrangement invented by Watt in 1784, which never passed the experimental stage.

In 1847, Von Rathen secured a patent on a turbine that was essentially the combination of four Hero engines. The interesting part about the design of this machine was the discharge openings. These were in the form of cones, and although the expansion given by the cones was far larger than actually required, the idea was a step in the right direction. This is shown by the fact that De Laval used it in more correct form in 1883 when he invented a turbine house in connection with his cream separator.

The next important invention was brought out in 1884 by C. A. Parsons, in which the fundamental patent principal was the expanding nozzle. This machine developed about 10 h.p. at 18,000 r.p.m., and was in service for several



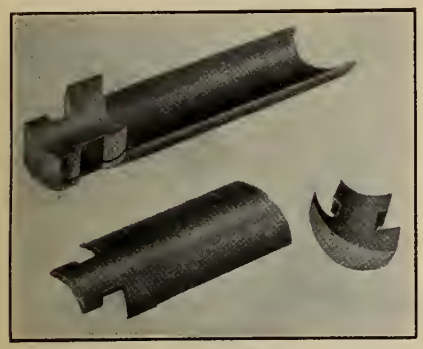
Branca's Steam Engine.

years. Other patents taken out from time to time bring us to the modern Parsons reaction turbine.

### Impulse Turbines.

The rotation of members by impact is an old story, and it is difficult to determine to whom the credit is due as hav-

ing first used it. In 1630, Branca applied this method in a contrivance used for grinding corn, etc. His engine consisted of a paddle wheel with radial paddles against which a jet of steam was made to impinge. The motion was transmitted through gears to a drum



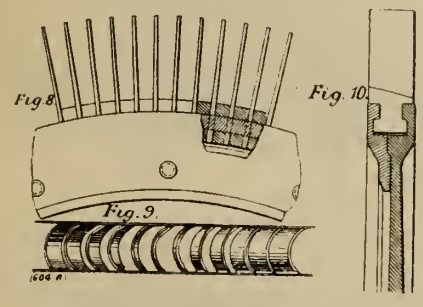
Blades in Detail.

which carried projecting cams that lifted and dropped the weights in the grinding mortars. The application of gearing is interesting. Other machines precisely similar were invented and re-invented, and in 1843 Pilbrow brought out a turbine of the impulse type that embodied many of the features which are to-day used on the modern impulse turbine in modified form. He used a system of compounding which is the same as that embodied in the Curtis turbine.

Robert Wilson, in 1848, brought out a turbine that differed from Pilbrows in that it provided for increase of area to recompense for the diminished velocity of the steam in its passage through the machine.

In 1889, De Laval began a series of inventions that had as their goal the solution of the simple impulse turbine. In 1895, Ferranti brought out further varieties of the compound type. These are interesting for the fact that either steam or gasseous products of combustion may be used.

David Cook, in 1896, patented a parallel flow turbine for use with an inter-




Method of Fixing Blades.

nal combustion arrangement. In the same year another of similar type, the Curtis turbine, was patented.

### The Zoelly Turbine.

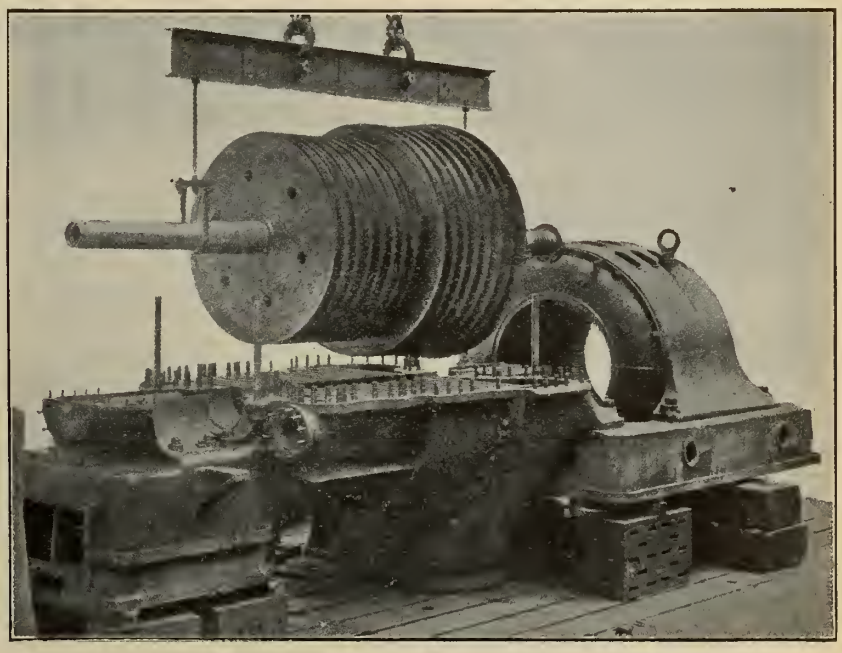
The latest turbine to reach any degree of importance in the power and transmission world is that one known as the Zoelly turbine. Naturally it derives its name from the designer, Heinrich Zoelly, manager of Escher Wyss & Company. Zurich, who put the first one on the market in 1904. The turbine became popular at once, which fact is amply demonstrated by the number of orders received the first year. These orders numbered 21, and aggregated 21,500 h.p.

The Zoelly turbine is of the multi-stage impulse type, that is, the steam is expanded successively through small ranges of pressure, the velocity acquired during each expansion being utilized by a separate single wheel. One of the chief features of the machine lies in the construction of these wheels, which permits of a relatively small number being used, owing to their ability to withstand the strains due to high rotational speeds.

The longitudinal section shown is not that of the turbine shown in the half tone, but will serve to show the arrangement of the wheels in their separate chambers. Each wheel runs in a compartment by itself, and the number of wheels is determined by the range of expansion. In no case is the pressure in a compartment less than 58 per cent. of that in the previous one.

The advantage derived from this limitation of pressure is that the nozzles may be of the easily designed convergent type instead of divergent nozzles, without interfering with the full expansion of the steam.

In the March issue will be a detailed description of the Zoelly turbine, and a Canadian instalation in which it is direct connected to a centrifugal pump. Following that will be a description of tests, methods used, and the results obtained in the test.



Turbine Showing Rotor Ready to Lower.

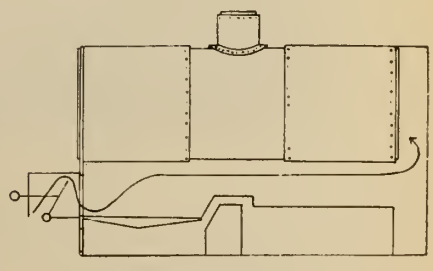
---

### FIRE DOORS.

By R. B. Douglas.

The accompanying sketch is of a fire door I have found very efficient for the complete combustion of smoke. It is practically a box with a shutter placed diagonally 2 in. from one corner. The sketch shows a side view, the arrow illustrating the effect. The effect of this door as a steam generator and fuel saver is amazing. It can be made at a very small cost and any engineer can fix it up.

The action of this arrangement is this : The air enters at the front of the door, travels over the shutter, down back plate of door and strikes the hot



Fire Door.

coal at the dead plate. When the air strikes the coal, it bursts into a flame. This flame completely consumes all the smoke.

# The Distinctive Features of Four-Cycle Gas Engines

## Definition of the Term "Four-Cycle," Showing Action of Gas in the Cylinder During Admission, Compression, Expansion and Exhaust.

As the gas engine is becoming more widely used as a motive power especially in small launches, elevators, etc., a definition of what is meant by the term "four-cycle" as applied to the gas engine will no doubt be of interest. The term is rather misleading. "Cycle" means a chain of events that follow one another consecutively until completion, when the cycle or chain of events is repeated.

In the four-cycle engine four strokes of the piston are required to complete the chain of events. First is the induction stroke when the mixture of air and combustible gas is drawn into the cylinder. The second stroke of the piston compresses the mixture into the clearance space of the cylinder, where it is exploded by a spark. The third is the expansion or power stroke and then the final stroke which exhausts the spent gases from the cylinder. After this stroke is the induction stroke again.

### The Otto Cycle.

In the year 1862 Beau de Rochas, a French engineer pointed out that in order to get a high economy in a gas engine it was important that the explosive mixture should be compressed to a high pressure before ignition. The cycle of operations he suggested occupied two revolutions of the engine, the four strokes being those outlined in the previous paragraph. This cycle was put into practical operation by Otto in 1876 and is known as the four or Otto cycle.

With this cycle there is only one working stroke in four. A heavy flywheel must be used to equalize the motion and distribute the work done as well as to do the work of compression, suction and exhaust, which is the work done by the piston in the other three strokes. High rotative speed is therefore an advantage. High initial temperature and pressure are desirable for the working stroke together with a low terminal value. Rapid combustion is required and the method of ignition is important.

Figs. 1, 2, 3 and 4 show the working strokes of the four-cycle engine. The mixture of gas and air is drawn into the cylinder by the downward movement of the piston shown in Fig. 1. The inlet valve, shown open in the figure is sometimes opened automatically but it is opened by the partial vacuum in the cylinder in the simply designed engines.

Fig. 2 shows the piston at the end of the stroke with the explosive mixture in compression. The ignition then takes place exploding the mixture which expands and forces the mixture down as shown in Fig. 3. This is the power stroke which gives the flywheel momentum to do the work required in the other three strokes. Fig. 4 shows the

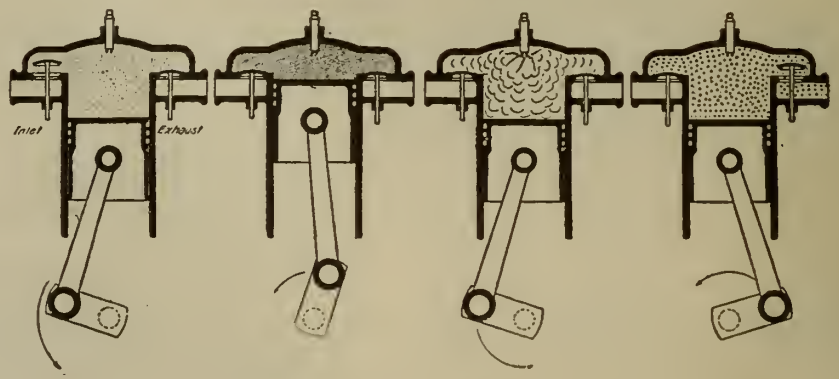



Fig. 1. Fig. 2. Fig. 3. Fig. 4.

position of the piston in the exhaust stroke, in which the upward motion of the piston forces the burnt products out through the exhaust valve which is mechanically operated in all four-cycle engines. This is called the seavanging stroke.

### Diesel Cycle.

An engine with another series of operations is the Diesel cycle. It also requires for strokes. The first stroke is the suction in which pure air is taken in without any mixture of gas. In the second stroke the air is compressed to a high degree. The clearance in the cylinder of the Diesel is about seven per cent. of the cylinder volume. The temperature of the air at the end of compression is about 1000 degrees F. with a pressure of about 500 lbs. per sq. in. This high pressure being reached gradually does not cause a shock to the engine. In the third stroke the admission value opens and a fine spray of combustible is blown into the cylinder. The moment the combustible meets the highly heated air it ignites and there is a forward movement of the piston. At an early point of the stroke, about one-tenth, the supply is cut off. The charge then expands and on the return stroke the products of combustion are discharged.

It has been noted that in the Otto cycle there is a composition of mixture of gas and air. The degree of this composition is limited since the heat caused by the compression may raise the temperature to the point of ignition. The amount of compression in the Otto cycle is regulated by making the clearance space large or small.

In the Diesel cycle the compression is not limited in this way. The operation depends on the compression raising the temperature of the air to the point of ignition of the combustible. This is a

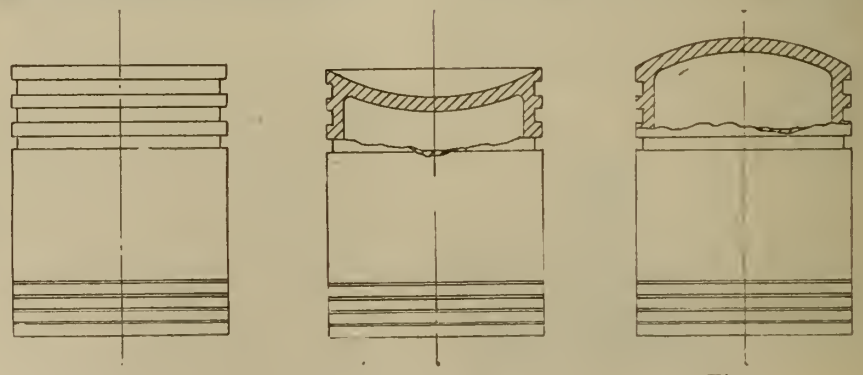


Fig. 5. Fig. 6. Fig. 7.

great advantage since the efficiency of a gas engine depends on high initial compression.

The illustrations show the varying shapes of the piston heads in four-cycle engines. Fig. 5 is a flat head. Fig. 6 is a sunk or depressed head and Fig. 7 is a crowned head. The pistons shown in Figs. 6 and 7 are not often used as they cause internal strains not in the direction of motion.

In the March issue of The Power House the "two-cycle" gas engine will be described and in the April issue several of the well-known makes of both four and two-cycle gas engines will be illustrated and their special features pointed out.

# Nelson, B.C., Municipal Hydro-Electric Power Plant

### History of Its Development at Bonnington Falls on the Kootenay River, With Description of Water Supply, Power House and Machinery.

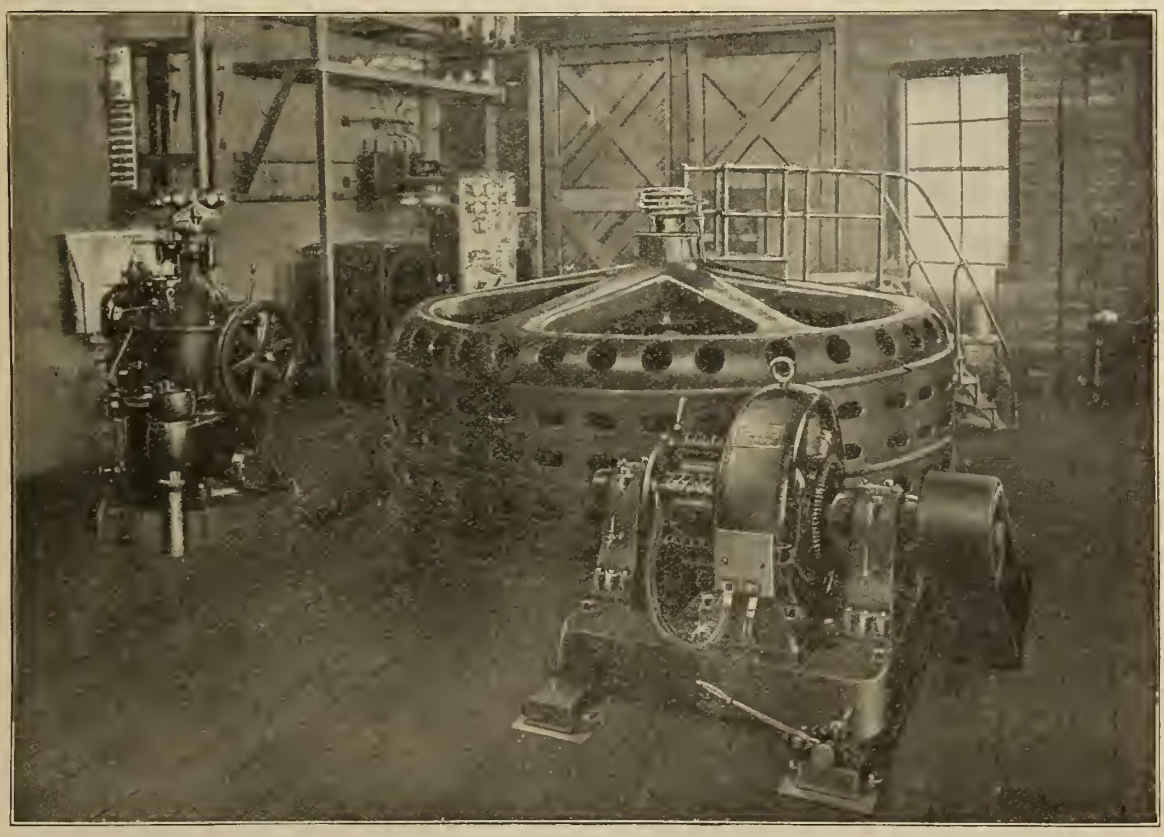
The city of Nelson has an up-to-date municipal hydro-electric plant situated at Upper Bonnington Falls on the Kootenay River. A start on this plant was made in 1902 when a by-law to raise $150,000 for power plant purposes was carried by the electors. Tenders were not called until March, 1905, however, and work of construction began in April, 1905.

The contract for both electric and hydraulic machinery was awarded to Allis, Chalmers-Bullock, Montreal.

The power house is built of concrete and brick, with a height of 28.6 ft. from wheel pit floor to turbine floor level and 8.6 ft. from thrust deck floor to generator floor. The following are some of the other dimensions: total height of foundation walls, 68 ft., height of generator to ridge of roof, 38.6 ft.; total height of building, 106.6 ft. The foundations are built of concrete, the vertical walls being six feet thick, there being also a six foot wall between each unit. Width of each unit, center to center of crosswall, 25 ft.; the turbine floor is a masonry arch with a depth of crown of arch of 4 ft.; the thrust deck floor is a masonry arch with a depth of crown of arch of 2 ft.; the generator floor is a masonry arch, with a depth of crown of arch of 2.6 ft. Between the turbine floor and the thrust deck floor there are two other floor levels of steel beams, which also act as steady bearing stiffeners for the vertical shaft. The foundations are completed to the elevation of the turbine floor level for four units, but above this level for two units only.

The power house superstructure is built of brick laid in cement mortar. The walls are thirty-two inches thick for a heighth of twenty feet to the ledge for the travelling crane, then for a height of ten feet to the wall plate, it is eighteen inches thick. The roof is supported by heavy roof trusses. The interior half of the generator room is 29 by 53 ft.

The generator is a 750 kilowatt umbrello type generator. With this vertical type, the total head at all stages of water can be utilized, so that the capacity of the turbine varies from time to time according to the high and low stages of the river. As designed, the turbine is intended to have a capacity of 1250 horse power, with a head of 40 feet. Average high water conditions give a head of about 52 ft. with a wheel capacity of 1600 h. p. while the maximum low water head is 65 ft. with a wheel capacity of over 2200 h.p.



Nelson, B.C., Municipal Hydro-Electric Power Plant.

The West Kootenay Power and Light Co. are constructing a new plant and when the improvements they have contemplated, of widening the river channel below the falls, are completed, they will have the effect of materially lowering high water conditions at the municipal

power house tail race, when the maximum high water will give a head of not less than 53 ft. and at low water a head of 65 ft. This will give a range of power with the one turbine of from 1650 to 2220 h. p.

The plant is constructed with an ultimate capacity ranging from 6,500 to 8,800 h. p. During the year 1908 a concrecrete draught tube was constructed. The forebay was raised 7.5 ft. and concrete weirs were built in the tail race to overcome the surge and wash of the falls. Steps are now being taken to install a second unit. The interior of the power house is being arranged for it.

The transmission line is nine and a half miles in length and consists of a seven strand aluminum cable, equal to No. 2 aluminum wire, carried on No. 16 Locke glass insulators and locust insulator pins, the wires of the circuit being spaced thirty inches center to center in the form of an equilateral triangle. The pole line is built on a right of way purchased by the city excepting for a distance of one and a half miles from the power house to Forty-Nine Creek, where it is on the public road allowance. This right of way, for a width of 50 ft. was cleared of all trees and brush, and all standing trees that were a menace to the power circuit. A second transmission line is now being erected.

The installation of the second unit necessitates the enlargement of the substation in the city to accommodate the transformers, switch board and other apparatus required. The provincial government has given the old court house to the city for use as a sub-station, and the apparatus is now being installed. When the plant is completed the city intends selling current to all users of power and light who desire it.

## MERRITTON LIGHTING PLANT.

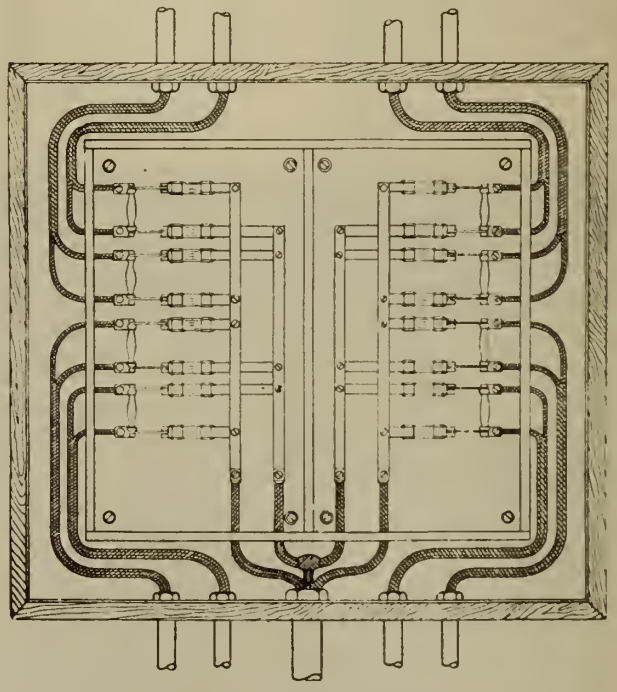
The new municipal electric lighting system at Merritton is completed and commenced operation on January 29th. Current is obtained from the Ontario Power Company on a long term contract. The town purchased the former electric lighting distribution system and overhauled it and added considerable extensions. The feature of the new combined system is the introduction of Tungsten street lamps, and their control by automatic means from the receiving station. The Tungsten system operated by distant control is a novelty in municipal lighting and especially adapted for towns where the cost of copper and of yearly operation must be kept down. The town council invited a number of officials of adjoining towns to see the system and lighting display when the current was turned on. There are 400 Tungsten lamps on the streets. Messrs. K. L. Aitken (now City Electrical Engineer of Toronto) and C. H. Mitchell, Consulting Engineer, Traders Bank Building, Toronto, designed and supervised the instalation which required the introduction of special apparatus and controlling devices to adapt the use of Tungsten lamps to street lighting.

## PANELS FOR 240-480 VOLTS.

The accompanying illustration shows the change of arrangement in 240-480 volt panels noted in a revision of bulletin No. 9, issued by the electrical department of the Canadian Fire Underwriters' Association. The three-wire main is divided as shown so that only the 240 volt side of the circuit will enter any one cabinet. This is a departure from the former method of installation.

This arrangement is in accordance with the National Code and will be used in all buildings where this voltage is specified. Rule 24 (a) of the code applies to this arrangement.

"Must be so arranged that under no circumstances will there be a difference of potential of over 300 volts between any bare metal parts in any distributing switch or cut-out cabinet, or equivalent centre of distribution."



Panel for 240-480 Volts.

## DISTRIBUTING COLD THROUGH PIPES.

By L. D. I., Toronto.

The first international congress on refrigeration met at Paris recently. Its object is to awaken interest in the industrial and domestic applications of refrigeration. Artificial refrigeration originated in France, but it has reached its greatest development in America. Cold is actually distributed to private houses in Boston, New York, St. Louis, Atlantic City, Baltimore, Norfolk, Los Angeles, Denver and Kansas City, through systems of pipes which vary in length from 1 to 18 miles. The financial results show a still greater variance. The business is very profitable in some places and unremunerative in others. The Denver company, for example, has been forced to suspend operations.

In general it has been found advantageous to concentrate the production of cold in large establishments and to employ the ammonia process. There are two methods of distribution; by chilled brine and by liquefied ammonia, which is allowed to expand at the place where the refrigeration is desired. The latter method is preferred, and is used exclusively in the newer instalations, although it requires a triple system of pipes. Both methods are in use in Boston and New York. In the method in which ammonia is distributed the tightness of all joints is very important, as leakage may entail losses that would make the enterprise unprofitable. Some companies use joints welded with the aid of Thermit and insert expansion joints at intervals. The iron pipes through which the ammonia flows are enclosed in tile pipes which rest on concrete foundations. It is rumored that a French company will establish a system of distribution of cold in Cairo, Egypt. The project includes a central station for the condensation of ammonia, 3 miles of pipes for the distribution of the liquid ammonia to a number of sub-stations, where it will be used to refrigerate brine, and 20 miles of pipes for the distribution of the cold brine to consumers.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

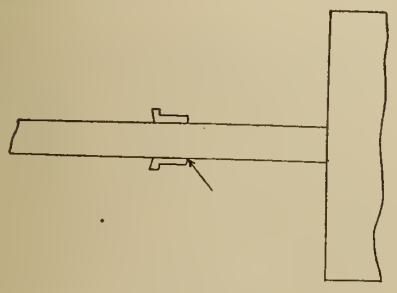
## CURING A KNOCK.

By Mac.

Last summer starting an engine which I had just erected, a knock occurred which investigation showed to be caused by the piston striking the bushing in the bottom of the piston rod stuffing box. Thinking that the clearance had not been equalized properly the rod was let out a trifle. Then the piston struck the head end.

By experiment a point was found at which there was no knock when load was on and only a slight click when load was off.

Recently I got a chance and opened up the engine and found that the bushing referred to above and which was a new one put in by the builders when they overhauled the engine, had been



Curing a Knock.

made as shown in the figure indicated by the arrow with a square corner and that the fillet on the rod was striking this corner. Rounding the corner cured the knock.

---

## PIPE COVERING IN CANADA.

By H. C. Morris.

Some Canadian engineers have apparently completely overlooked a point that is of great importance, pipe covering. This subject is one that, apparently, is treated lightly, or, if the necessity of covering is acknowledged at all, the cheapest is generally considered to be good enough ; yet it is indisputable that covering is a most important factor in the proper and economical operation and maintenance of a steam plant, but perhaps the reason for the hesitancy on the part of engineers to purchase a covering of higher value is that so many false and misleading statements have been circulated as regards the lasting quality and efficiency of coverings of no merit whatever.

It is curious to note the hold that Mineral Wool Pipe Covering has, even at the present day. This style of covering has been applied on high pressure steam pipes, in plants that are otherwise equipped in the most modern and up-to-date manner. The durability and efficiency, are low and it will pulverize and settle with slight cause. This settling action will leave the top of the pipe, where most heat is lost, almost completely unprotected, and the dust which gathers at the bottom of the canvas jacket is useless. This is a style of covering which has been discarded, and is not considered at the present time as a pipe covering throughout the United States.

Another style of pipe covering very widely used is sold as moulded asbestos. There are forms of moulded asbestos pipe covering on the market which possess value, which are made with the maximum amount of long fibre asbestos and insulating materials. A pipe covering of plaster of Paris is very dangerous to pipes on which the covering is placed, as it will start corrosion ; and, as this will progress under the covering, it may even have dangerous results in time.

Another common practice is to apply hair felt to pipes carrying high pressure steam. The hair felt, under the high temperatures, will dry out and become about the most inflammable material, short of gun cotton.

There are several things it is well to remember when considering pipe covering. Insulation, commercially speaking, is based on the fact that dead or confined air will not carry heat unless that heat is accompanied by light. Heat is taken away from pipes and other heated surfaces by the circulation of the air, not by radiation, so, while a covering should possess dead air spaces, and it may follow that its efficiency is in a direct ratio to the volume of air confined, the character of these dead air spaces is of even greater importance than their volume. As an instance :—A room without vent, doors or windows, may be considered a dead air space, and yet a radiator or pipe running in that room will lose a considerable amount of heat, because there is sufficient space for the air to circulate, and the air is not confined. In every case where the air is in the most finely divided cells, then the covering possessing the greatest number of these cells possesses the greatest insulating efficiency. As pipe lines are always subject to more or less vibration, it is well to select a covering which is not of a powderous nature. It is easy to see that a material of which the basis is a powder and the covering is made up by moulding, will crack and eventually disintegrate, and a covering made from a material possessing more of a texture is a distinct advantage.

There are two or three coverings which are furnished by The Canadian H. W. Johns-Manville Co., Limited, Toronto, one called Asbestocel Covering. This is built on the air-cell principle, but the cells are very small and run around the pipes, instead of along them. In the air-cell covering, which is familiar to engineers, there are four ply of corrugations to the inch of thickness, and in this Asbestocel Covering there are twelve ply ; these, running around the pipe, act on the arch principle, and give mechanical strength to the covering. Its basis of pure asbestos felt gives toughness and durability. Its insulating efficiency is materially increased by the more true confinement of the air, and, for steam pressures up to, say, 100 to 110 lbs., it effects all the saving consistent and possible with true economy.

For higher pressures of steam, where the differences in temperature are so much greater, and the condensation, in the case of poor insulation, necessarily more, a covering of a higher efficiency, even at a little higher cost, is more than worth while.

Steam at 80 lbs. pressure contains some 10 per cent. of moisture, in any case, yet steam at 120 lbs. pressure contains only 1.7 per cent. Between these two pressures, at a point varying according to plant conditions, there is an inconsistent drop in the amount of moisture contained in the live steam, and a change in the character of the steam in this way necessitates covering of a higher insulating efficiency, in order to preserve the full benefit derived by using the dry high pressure gas. Asbestos-Sponge Felted Covering is for use in this case. It is composed of successive layers of asbestos felt, containing a proportion of ground sponge. These are laid over each other, layer on layer, sixty layers to the inch, and are stitched through with metal. The joint is on one side. It can be walked on while on the pipes without detriment ;

it can be wet and will dry out again without injury ; and can be taken off and replaced as many times as may be desired.

As an example of the value of the saving to be effected by a good class of coverings, the following is based upon the authority of wholly disinterested persons :—

Air-Cell Covering, 1" thick, four ply of corrugations to the inch, will effect, upon pressure of 80 lbs. steam, a saving, in condensation, over bare pipe, of 74 per cent.

On higher pressures, in consequence of change in the character of the steam, and the fact that a covering is capable of preventing the passage of just so much heat and no more, its efficiency is reduced and, on 150 lbs. steam pressure, is not more that 60 per cent.

Take a pipe system covering a plant of 5,000 square feet. The law of loss of heat, as established by Kent, Professor Robb and other eminent authorities, on the subject, is that there are 3 British Thermal Units lost per hour per square foot of surface per degree difference in temperature between the steam and the outside atmosphere. Steam at 150 lbs. pressure has a temperature normally of 366 degrees. Granting an atmospheric temperature of 80 degrees as an extreme, this shows a difference between the steam and the atmosphere of 246 degrees.

On the formula referred to above, there would be in this system, an hourly loss of 3,690,000 B.T.U.'s. The available heating value of a pound of coal (deducting losses through the gases of combustion passing off through the breaching) based on a good, anthracite coal is 9,000 B.T.U's. In a year of 300 days of 10 hours each, on bare pipe, therefore, this system would lose and waste the heating value of 615 tons of coal. The air-cell covering, with an efficiency, on this steam pressure, of 60 per cent. saving of the loss caused by bare pipe would effect a saving of 369 tons of coal per year. Asbestos Sponge Felted Covering, with an efficiency, on this steam pressure, of 87 per cent. effects a saving of 535.05 tons of coal per year, or a difference and superiority over the air-cell of 166.05 tons of coal. Rating the coal at a price of $4.00 per ton, this equals a difference in the saving, of $664.20, and, at this saving, which is absolutely practicable, the entire difference between the two coverings, may be paid in less than the first year, which shows an annual return and saving in the coal for an indefinite period. This saving is further increased by the amount of labor saved in handling the extra quantities of coal. This saving would be effected, in addition to the almost equally important factor of reducing the amount of condensation carried in the steam to the engines. Another point to be considered, is the reduction of expansion and contraction of the pipe line, and the consequent reduction in the tear on the line ; this directly results in a less cost of maintenance.

A third covering worthy of mention is called "Asbestos Fire Felt." This is made by taking the longest fibres of asbestos—the grade usually used in weaving cloths, etc.—and by a certain process, felting it together so that there are myriads of minute air spaces. One to two per cent. of a silicate solution acts as a binder. It is readily seen how valuable such a covering is in cases of superheated steam, or for other extreme temperatures. Asbestos stands heat up to 1400 degrees to 1500 degrees. As a silicate, it is proof against all acids, with the single exception of hydrofluoric. Alkalies have no action on it whatever. The binder is a silicate and quite as impervious as the asbestos itself.

To sum up :—The problem of properly protecting the steam pipes is one deserving the immediate and careful attention of Canada's engineers, as it is a subject along which no progress has been made during the last ten years. In the study of Canada's development and growth along every line, it is curious to see that, in the engineering field, where such strides have been made, such an omission should occur. From the most modest sawmill to the largest plant, the question of pipe covering is one most deserving of careful consideration.

## PUMPING BY COMPRESSED AIR.

By Dhu Roe.

In order to comply with the underwriters' requirements and at the same time provide a speedy and economical

Pumping by Compressed Air.

method of handling large quantities of benzine, we adopted the following means:

A 6,000 gal. tank situated in an open space had a 70 gal. tank placed under it and connected to it by a 1 in. pipe, provided with globe and check valves. A ⅜ in. pipe from the top and a ¾ in. pipe from the bottom, counected the smaller tank to the main building some 300 ft. distant, and 40 ft. above the tank level. The ⅜ in. pipe is shown in the illnstration joined to the compressed air line C with pressure gauge and relief valve on the tank side D of the stop valve A. Valve B is provided as a blow-off for any moisture which may collect in main air line. The ¾ in. pipe is led to a convenient position for discharging the benzine into 50 gal. tanks mounted on trucks. This pipe has a drop of ¼ in. to 1 in. from the discharge valve to a point above the main tank, thus insuring the rapid return of all the benzine in the line immediately the air is shut off. The relief valve R is left open when the system is not in use, and the pressure gauge was provided as an extra precaution to detect any leakage of air on the line to the tank which might, if valve R happened to be left shut, force the benzine up to the discharge valve in the building, a condition of affairs which the underwriters will not accept.

## ENGINE BRASSES AND THEIR ADJUSTMENT.

By Frank H. Chesher.

Very often engineers differ in the proper ways and the effects of keying up engine brasses. Of course, conditions must be taken into consideration, so the engineer must use his best judgment.

The methods of constructing connecting rods are so different that it would be wise to commence in an article with some of the older patterns. If it were not for the wear on the crank and wrist pins of an engine it would be possible to make a connecting rod of one piece, providing of course that it did not wear. For that reason brasses are used and so arranged that all lost motion can be adjusted.

Fig. 1 is a type of connecting rod

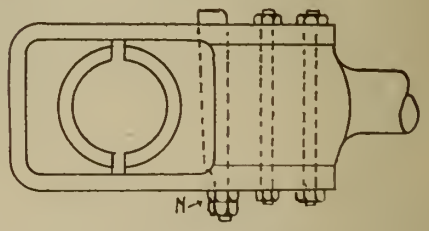



Fig. 1.—Connecting Rod.

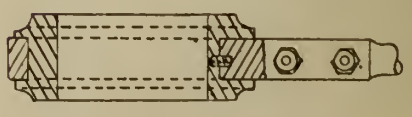


Fig. 2.—Sectional View.

shown in two positions, Fig. 2 being a sectional view. It can be seen from Fig. 2 that the strap is the same as Fig. 1, with the exception that the slot is made only large enough for the key, there being no gib used when adjusting these brasses. The key is held in place after being adjusted by means of the two nuts N. The butt end of

the rod is drilled for the two bolts which pass through holes in the straps and is held in place by the two bolts as shown.

Another type of connecting rod is shown in Fig. 3, the adjustment of the brasses being by means of a cap screw attached to a wedge, by means of which the wedge is lifted or lowered as desired. As shown, the taper of the wedge and that of the brasses gives a large and even bearing against each other. As the wedges are placed inside of the pin on either end, the length of the rod remains the same when keying up for lost motion, providing, of course, that

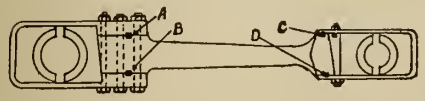



Fig. 3.—Rod with Adjustable Brasses.

each brass has an equal amount of wear.

With this type of connecting rod the straps on both ends are held in position by two bolts, thus insuring a rigid adjustment. This strap has another improvement in the form of cross keys, shown at A, B, C and D, which take the strain from the bolts. In this case the adjustment is made by forcing the wedge down, which pushes the inner brass toward the outer ends of rod.

In Fig. 4 is shown a type of connecting rod in which the adjusting wedges of the brasses are placed one inside and one outside of the pin, in order to equalize the wear of the brasses and prevent the lengthening of the connecting rod, as would be the case if both wedges were placed inside of pin. It will be noticed that the adjusting key passes entirely through the rod and is held in place by means of the nuts.

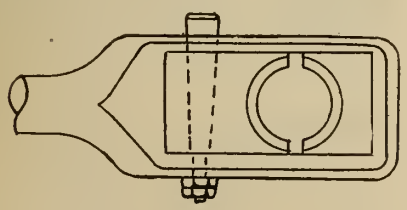


Fig. 4.—Equalizing Wear of Brasses.

The connecting rod shown in Fig. 5 is made with solid ends, slotted out square. The brasses are made a good fit in these spaces, and are adjusted by means of wedges placed horizontally in the ends of the rods. The adjustment of the wedges is rendered easily accessible, especially so at the cross head end. The wedges are so constructed that they rest on the brasses the full width and depth and are operated by means of a screw bolt, which allows very fine adjustment. A small set screw underneath the rod is added as a safety check.

In this type of rod the design is such that the taking up of lost motion leaves the distance from centre to centre of pins constant.

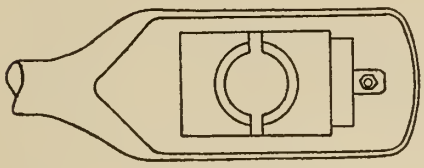


Fig. 5.—Rod with Solid Ends.

Another type of rod is shown in Fig. 6, in which the strap is the special feature. Otherwise it is a plain strap joint rod in all respects. The adjustment of the brasses is made by means of a key, no gib being used, the brass being tapered to fit the taper on the key. The key is secured by an ordinary set screw.

It is a well known fact that a square bend in the forging is always the weakest part. To overcome this difficulty this strap (Fig. 6) has been designed and built up of four pieces—the sides, end and end bolt.

In this pattern of strap the tenons in the end pieces have a shearing strength equal to the tensile strength of the

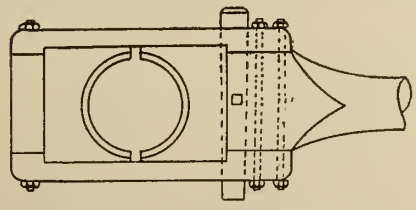


Fig. 6.—Rod with Special Strap.

sides. The tenons are fitted into counterbores in the sides and are supposed to take all the strain, while the bolt only holds the parts together.

The type of rod shown in Fig. 7 is a solid end rod with two-bolt adjustment. Adjustment is made by means of the two bolts, by which one adjusts the brasses and the other holds fast after adjustment. This wedge can be made to adjust from either top or bottom, as desired, but I believe the upper the more satisfactory.

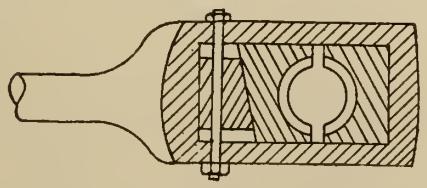


Fig. 7.—Rod with Solid End.

The connecting rod shown in Fig. 8 is of the marine type. The box part as well as the strap is securely bolted to the connecting rod end, the box being fitted into the strap, and is adjusted by means of a wedge and bolt, giving a quick and positive adjustment. The other end of the rod shows the brasses to be adjusted by means of a taper wedge passing through the rod sideways.

The connecting rod shown in Fig. 9 is worthy of attention. It has been found that by filing away a certain amount of the top and bottom of the ordinary brasses that better lubrication has been obtained and that wider space can be left between the brasses to allow for keying up without again having to file them at this point. In this rod, even after considerable wear, the form is

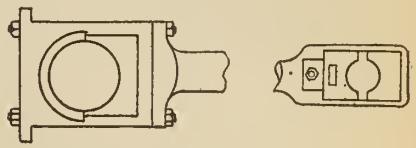


Fig. 8.—Marine Type Rod.

still the same as that shown in the sketch, without the necessity of filing the brasses at all. The adjustment is made by means of a tapered wedge.

With the type of connecting rod and brasses shown in Fig. 10, the brasses are split and held against the end of the steel rod by means of the strap, and secured with a gib, a key and a set screw. As shown, A is the connecting rod and is cut out so that the gib and key may pass through the stub end, which butts up against the brass B. The strap, C,C, holds the brasses D and B in place. The strap is cut out for the passage of the gib and key, the hole being the same size as the hole in the connecting rod, but they do not correspond. Into these holes the gib is first placed, as shown, so that the nose

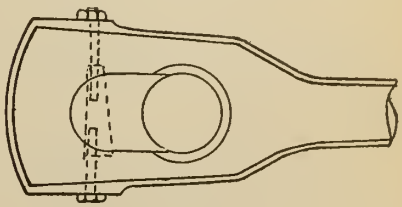


Fig. 9.—Eliminating Filing of Brasses.

rests upon the strap, in order to prevent the strap springing open. When the key is inserted and driven in, the two sections of the boxes are forced together until the proper amount of tightness is secured. When the brasses are fitted to the pins as desired, the key is held in place by means of a set screw. The space between the brasses should be filled up with liners.

It will be seen that in the majority of the types herein described that the keying up of brasses does not change the clearance of the piston in the cylinder, therefore, the length of the rod is

not changed as is the case with some types of connecting rods.

I have one point more that I would like to mention regarding engine brasses. I have fourteen engines in my plant and, as you will know, plenty of brass fitting to do, especially when you consider that nearly all the engines are overloaded. I find that for easy running and cool brasses they must be kept cleaned well back from the edges, and not to be butted, but to have a liner of leather, or some other material, between each, as that will compress as we key up. My opinion is that the brasses should not be butted. I would like to have the comments of the readers of The Power House on this point, as some authorities say that the brasses should be butted.

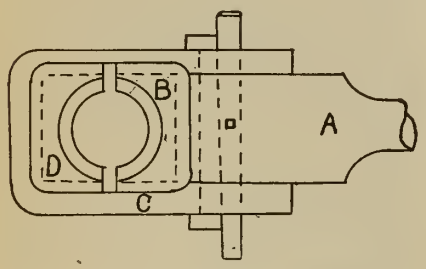


Fig. 10.—Rod with Split Brasses.

## REPAIRS AT SEA.

By Eight Bells.

The following is an instance of an efficient repair of a 2-in. copper pipe which broke at the junction of pipe and flange, through the brazing. The pipe in question was the steam pipe to the automatic feed pump for the main boilers. It occurred when some days out of port, with a fairly long run still to go. The flange was bolted to the steam chest of the pump by four ⅝-in. bolts. Four strips of ¼-in. Muntz metal were cut, 1½ ins. wide, and bent to a right angle, or L-shaped.

Before being bent, they were curved part of their length to the radius of the pipe. A ⅝-in. hole was drilled in the flat part to fit over the bolt, and they were then bolted on to the flange.

The next step was to make a clip, in halves, to fit over the pipe and Muntz metal. A thick asbestos cloth gasket was put between the Muntz metal strips and the pipe. The clip was put over this and screwed tight. This took the strain off the brazing, and transferred it to the metal strips, while the joint stopped the leak to a great extent. When taken off at the next port, it was found that the original break had extended but very slightly, and there is no doubt the repair would have carried us much further if required.

I remember of a small patch being put on a ship's hull, some three or four feet below the water line, in a pretty ingenious way. It was right up in the eyes of the vessel some six feet from her stem, and the crack was about 1½ ft. long and ⅜-in. wide. It did not endanger the vessel in any way, but would have filled the forepeak, which was very small, but being an old vessel it would have had to be pumped by hand, and as there was no super-abundance of men that was a big consideration. A piece of plate was found, large enough to well cover the hole, and six ⅜-in. holes were drilled in it. This was then put over the crack, and the holes marked off on the inside. They were then drilled and as each was drilled they were plugged. In the meantime, small feathers were fitted into the bolts, to prevent them turning.

When all was ready, and a rubber joint cut for the patch, a light string attached to a small round stick was passed through each hole, and floated to the surface. A piece of siezing was attached to the string, and pulled through, and the wire was attached to the bolt in each hole.

The bolts and plates were then lowered down. The bolts were fished through the holes by the wires, the nuts were screwed up, and there was no more pumping required.

Winches are a frequent source of trouble in cargo-carrying ships, and give the unfortunate engineers many an extra hours' work. The temporary repairs are almost innumerable. In one case I had a new crank pin to fit into a disc crank and gave it to the fourth engineer to do. It wanted to be a good fit, but in his eagerness to ensure its being tight, he drove it in hard enough to crack the disc from the pinhole to the edge. The result was a prolonged hunt through the stores, tunnel, etc., for a piece of bar iron long enough to make a loop. The same not being forthcoming, we were about to give it up, when the carpenter, who had a great habit of accumulating scrap, was consulted. He forthwith produced an old hatch batten, which was pronounced the very thing. After several attempts, we succeeded in welding this to form a ring, just a shade smaller than the disc. Then it was heated again, driven on, and allowed to cool out, when the shrinkage effectually tightened it up.

This may sound easy, but it entailed much thought, hard work and many hearty deep-sea curses, especially the welding part. Another time, when trying to stack a piston nut off a winch piston, one of the juniors succeeded in twisting the end off the rod flush with the piston. This was fixed by drilling a half-inch hole into the rod for about three inches deep, and putting in a long tap bolt, with a washer big enough to cover the hole. The piston was fortunately a tight fit on the taper part of the rod, and in spite of many gloomy prophecies it held all right till the cargo was all out, which was all we needed.

## BOILER COMPOUND FEEDER.

By Wm. Young.

For the convenience of a brother engineer I shall endeavor to make plain the simple method which I used with great success. At first it was a puzzle.

A paper mill, in which I worked, used coal oil as a compound. When I went there, they were trying to put this oil in their boilers by the use of the injector, where the feed water was taken from a barrel, as shown in Fig. 1. The oil, of course, would always stay on top of the water and if the water was allowed to be low enough for the injector to lift the oil it would "kick off." I studied a long time and finally tried the arrangement given in Fig. 1.

H is the injector, F the barrel from which the feed water is taken, D the suction pipe, with fitting 2x2x1-in. facing, E the chamber, which is a piece of 5-in. iron pipe with caps on each end and the caps tapped for one-inch pipe, X and W are two one-inch globe valves fitted to the chamber with plugs in one end and stuffing nuts facing each other, holding a water glass which acts as gauge. I is a valve which is closed at all times except when in operation. G the funnel into which the compound is poured, must be in operation before valve I is opened to allow compound to feed in. This arrangement can be used for any kind of liquid compound.

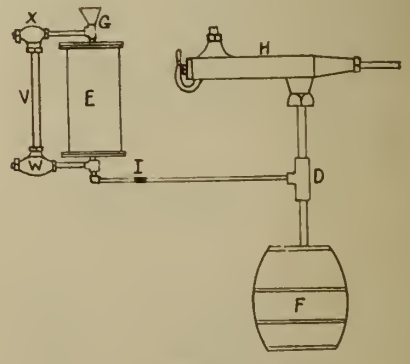


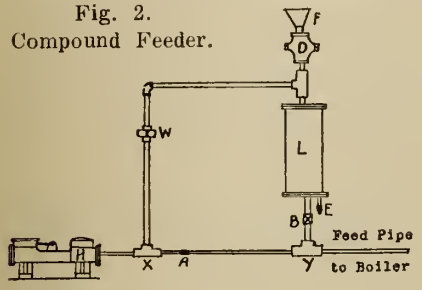
Fig. 1.—Compound Feeder.

To feed coal oil valve I must only be open about one-eighth of a turn, just enough to allow it to feed. Fig. 2 shows a similar arrangement attached to a pump. H is the boiler feed pump of the regular duplex pattern with the usual discharge pipe to the heater and boiler at X and Y. The pipe was cut

and T's placed in, as shown, A, B and C are valves, L is the chamber into which the compound is poured through the funnel F and stop-cock D.

The chamber is made of 5-in. iron pipe about 26 ins. long with caps on each end and the caps tapped for pipe the same size as feed pipe, which, in

Fig. 2.
Compound Feeder.




this case, is 2-in. pipe. To fill the compound feeder valve, A is open, C and B are closed, the drain, E is opened to relieve any pressure that may be in the chamber and to drain out water when desired. The stop-cock D is then opened and the compound is poured into the chamber through the funnel F, the amount being governed by the work the boilers are doing. E and D are then closed. C and B are opened and A is closed. This forces the feed water up through C into chamber L, and down through valve B, forcing the compound into the boiler. W is a union. Gate valves should be used at A, B and C.

## A SIMPLE OIL PUMP.

By J. M. Sewell.

The oil pump shown herewith was designed primarily for refilling the tank of a steam engine, employing a system of gravity lubrication, and so far exceeded all expectations in regard to its capacity and efficiency, that an extra overflow pipe had to be provided for the tank.

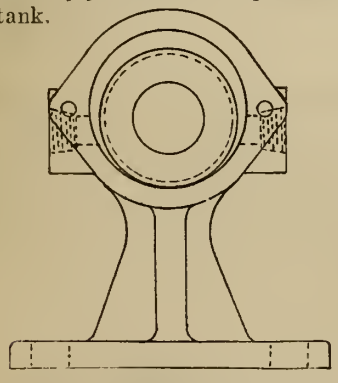


Fig. 1.—Sectional View.

Referring to the sketches, Fig. 1 is a sectional view, showing an assembly of the pump. Fig. 2 is an end elevation with the cover and shaft (shown in Fig. 3) removed. From these views it will be seen that the bore for the shaft is eccentric with the main chamber of the pump and that the inlet may be on either side, depending on the direction

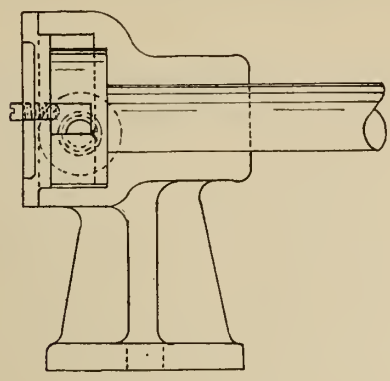


Fig. 2.—Face View.

of rotation of the shaft. A small vane shown in Fig. 4 is made in halves, and is free to slide in the slot shown in the headpiece of the shaft. A spiral spring

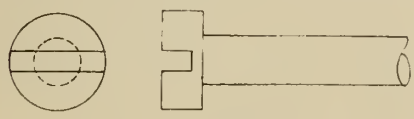


Fig. 3.—Shaft.

placed between the vane pieces keeps the latter always in contact with the bore of the pump and thus insures a forcible discharge of the fluid dealt with.

Owing to the simplicity and cheapness of its construction, combining positive action with light weight and a minimum

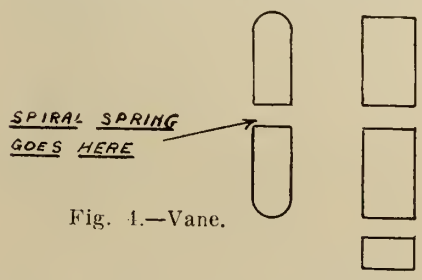



Fig. 4.—Vane.

number of parts, it is a design which cannot fail to give satisfaction wherever a lifting or circulating pump is desired. Its particular field would seem to be steam engine lubrication, water circulation for automobiles, and as a feeder on turret lathes and other machine tools.

## EXHAUST STEAM AND CONDENSATION WATER.

By John Thurlow.

Last December I took charge of the plant in which I am employed at present, and I found out that all the water of condensation, and a lot of exhaust steam was going to waste. We engineers are all aware of the value of condensation from a heating system as a purgative and non-scaling factor in the way of boiler feed water.

The blow-off, stop valve, flange joints and other things were leaking badly. The Moffatt feedwater heater and purifier and oil extractor was very dirty, in fact, the excelsior was baked so hard with the scale forming substances taken from the water that I had to cut it out in pieces. We have a 16x38-in. simple Wheelock, and have taken cards off her when she was doing 195 h.p. The noise the exhaust steam made, when passing through the heater was terrific, especially when engine was pulling heavy. They had a veritable iron pile inside on the excelsior to hold it and the plates in place.

I cleaned the heater out thoroughly, and found the exhaust pipe choked up with a hard, brittle scale until the area of it was only half what it should be.

After starting up again I had no trouble with plates upsetting, nor rattling, nor did I use any iron to hold them down. I clean the heater every four weeks and it is surprising the amount of scale-forming substances that are retained in the filter especially in the top chamber.

The oil extractor was not working as it should, as it allowed oil to get into the feed-water, but after proper attention it has since done its duty all right.

The firm had a room on the second floor which they wished heated to warm their doors in before they glued the morticed joints.

I piped it up with 500 lineal feet of 1,-inch pipe, and fed it with a 2-inch exhaust after it came from main drying kiln, also a warming kiln on ground floor where lumber (hardwood for finishing work) was stored after drying, so as to not draw dampness. Then I piped it up to the paint shop, and have it arranged so as to use either live or exhaust. It also works fine. The room with 500 feet of 1-in. pipe in it is very hot, and it is 16x18x8 feet, and fills a long-felt want.

Our boiler room is about 2 feet lower than ground level, so I put an underground 4-in. pipe and connected all the drips from the steam coils and kilns and run them to the boiler room. Here we had a double stroke belt-driven pump feeding the boiler, and running on short stroke. I connected the condensation pipe to one side, and then lengthened the stroke on other side to feed the boiler, and it works fine. We get enough water to supply half of our feed water to boiler, making our water consumption just half, also cutting out a lot of live steam in the paint shop, saving fuel.

I also packed all leaky joints, put in some new valve seats, and packed their stems, put in new blow-off, and have left the plant Saturday at 12 o'clock noon with 80 lbs. pressure, and went in Monday at 5 a.m. and found 20 and even 30 lbs pressure.

# Correspondence and Discussion on Previous Articles

We Welcome Discussions on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### TO OUR READERS.

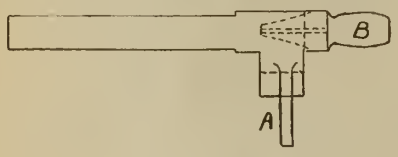
We welcome discussion on articles appearing on the previous pages. Perhaps they suggest some experiences you have had. Write us about it. We will prepare it for publication and will remunerate you for it.

If you have difficulties, write us about them and we will publish them in The Power House. Your name will be withheld if you do not wish it published. We invite engineers to send in answers to questions asked. We pay for these also.

Address letters to The Power House, 10 Front St. East, and they will reach the editor.

### GAS BURNER.

Editor Power House,—I note a letter on page 31 of the December issue of The Power House regarding a Gas Burner. As my specialty is gas and other internal combustion engines, I




Gas Burner.

have much pleasure in enclosing a sketch and description of what will probably suit him.

The vent in the gas connection B must be small, 1-32 inch being large enough to give a fairly hot Bunsen flame with a small quantity of air. A is the air connection.

J. DOUGALL.

### EFFECTIVE SILENCERS.

Editor The Power House,—I have read the articles and discussion in The Power House on Muffling the Exhaust. The following is a description of a type of silencer which gave excellent results on 250 b.h.p. gas engines.

The exhaust pipes ended in bell mouths flush with the brick walls of the silencer chambers, and about 2 inches above the floor level. Each chamber was 4 feet square and 6 feet in height, and was connected to a sewer. The first 2 feet served for expansion chambers, the next 3 feet contained well-rounded flints taken from a river bed. These were carried on iron grids and made very effective mufflers. One foot of space was left at the top for the gases to accumulate in and a length of 10-in. pipe flanged and bolted to the iron cover of each chamber served to carry the gases well up into the atmosphere.

An interesting feature of this installation was the use made of the waste heat from the engines. The exhaust pipes were laid in a well protected concrete trench, which was kept filled with water through a ball cock. This water was fed to the boilers (large quantities of low-pressure steam being used in the factory) through a stack of economizers. At lightest load a 15-degree rise was realized, which showed a considerable economy on the coal pile.

DHU ROE.

### ONE OF MANY.

Editor The Power House,
10 Front St. East,
Toronto, Ont.

Dear Sir: Enclosed find $1 being payment for one year's subscription of The Power House.

Please send it to the following address, Mr. Chas. Barnes, Brantford, Ont.

For securing the same please send me premium called "Power Stations and Transmission," by Geo. C. Shaad. E.E. I expect to land another one in a week or two, as I have the promise of another one

I am delighted with the progress your journal is making, as it contains much valuable information, and I can plainly see it continues to improve. Have you any more room for a letter in the February issue? If so, let me know at once, as I have a good article on "Exhaust Steam and Condensation."

Trusting this will be satisfactory to you, I am,

Sincerely yours,
JOHN THURLOW.

### NOVEL POWER PLANT.

Editor The Power House—There is a great future for the low pressure turbine about which so much is being written at the present time. In this connection, a unique power generating station recently built in the North of England, should be of interest to users of power in Canada, as it shows the possibility for economy in the manufacture of electricity by proceeding along lines which have received little or no attention by power users up to the present time.

This plant presents the unusual spectacle of a steam-driven generating plant without a boiler-house. It is owned by an electricity company, but is built by arrangement on the property of a large pig-iron mill. This mill develops a large amount of steam for operating its own machinery, using cupola gases as fuel, and then turns over the exhaust steam to the lighting company for the operation of two low-pressure turbines aggregating 3,000 kilowatts in total capacity.

Another unique plant in the North of England, which shows where a saving may be accomplished, is one of 4,000 kilowatts. The waste gases from the ovens of a neighboring new-process coke manufacturing company, are used as fuel.

OLD COUNTRY.

### PROBLEM IN FRICTION.

Editor The Power House:

The following is a problem I would like to have a reader of The Power House answer:

What would be the horse-power required to move two ton up an inclined plane 60 feet long, having a rise of 17 inches in that distance?

ENGINEER.

### DUSTING ELECTRIC APPARATUS.

By B. P. A.

We have considerable small electrical apparatus in our laboratory which required to be dusted very often. It took considerable time until we installed the present system of cleaning by an air blast.

A small water motor was procured and attached to the water tap. With it there was no waste time taking out pieces and rubbing them free of dust. The air blast cleaned the pieces effectively. In power plants compressed air is used to blow the dust out of generators and motors and we couldn't see why it shouldn't work with small apparatus. We tried it and found it very effective and a great time-saver.

## SOCIETY OFFICERS.

**Canadian Railway Club, Montreal.**

President, L. R. Johnson; treasurer, S. S. Underwood; secretary, James Powell, Box 7, St. Lambert, near Montreal. Meetings at Windsor Hotel, 1st Tuesday of each month, except June, July and August.

**Central Railway and Engineering Club, Toronto.**

President, C. A. Jefferis; Sec-Treasurer, C. L. Worth; Room 409, Union Station. Meetings at Rossin House, 3rd Tuesday of each month, except June, July and August.

**Canadian Society of Civil Engineers.**

Rooms at 413 Dorchester Street West, Montreal. President, Geo. A. Mountain; secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday until May 1st, 1909.

**Nova Scotia Society of Engineers, Halifax.**

President, J. H. Winfield; secretary, S. Fenn, Bedford Row, Halifax, N.S.

**Quebec Branch of the Canadian Society of Civil Engineers.**

Chairman, E. A. Hoare; secretary, P. E. Parent, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

**Toronto Branch of the Canadian Society of Civil Engineers.**

96 King Street West, Toronto. Chairman, C. H. Mitchell; secretary, T. C. Irving, Jr., Traders Bank Building.

**Manitoba Branch of the Canadian Society of Civil Engineers.**

Chairman, H. N. Ruttan; secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

**Engineers' Club of Toronto.**

96 King Street West. President, A. B. Barry; secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

**Canadian Electrical Association.**

President, N. W. Ryerson, Niagara Falls; secretary, T. S. Young, Canadian Electrical News, Toronto.

**Canadian Society of Stationary Engineers.**

President, Charles Kelley, Chatham; secretary W. A. Crockett, Mount Hamilton.

**Toronto Branch A.I.E.E.**

Secretary, W. H. Eisenbeis, 1207 Traders Bank Building.

**Universal Craftsmen Council of Engineers. Canada Council.**

Chief, Chas. Mosley, 7 Charles St., W.; Secretary, H. E. Terry, 157 Bay St. Meets second Tuesday in each month in Room 2, 4th Floor, Temple Building.

**Toronto Branch C.A.S.E.**

Meetings 1st and 3rd Fridays each month at Forum Hall, corner Gerrard and Yonge Streets. Pres., F. Stubbs; Secy., W. C. Tait.

## TORONTO C.A.S.E.

An open meeting of the Toronto No. 1 lodge, C.A.S.E., was held in their rooms, corner Yonge and Gerrard Sts., on Friday evening, January 29. O. A. Cole, manager of the Philip Carey Co., read an instructive paper on "Heat and Cold Insulation." This paper is reproduced in this issue. The next open meeting will be on Feb. 19, when Prof. Bain, of Toronto University, will read a paper on Oils and Lubrication.

## NOVA SCOTIA MINING SOCIETY.

The annual meeting of the Mining Society of Nova Scotia will be held on March 3, 1909, at the rooms of the Society, 129 Hollis Street, Halifax, N.S. The annual dinner will be held during the session.

## McGILL ENGINEERING SOCIETY.

The meeting on Jan. 18, was addressed by Professor Tucke, head of the Mechanical Department of Columbia University, who made a special trip to Montreal to address the students on the subject, "Gas Engine." He dwelt on the subject from a commercial basis, and outlined the material for power plants and the evolution of the gas engine, comparing the efficiency of the gas engine with that of the steam engine, giving valuable statistics.

## BRITISH SCIENCE ASSOCIATION.

Arrangements are being made for the meeting of the British Association of the Advancement of Science, in Winnipeg. The convention will be held in the drill hall, while the opening meeting will take place in the Walker Theater, the evening of August 25th. This will be a very important convention and a great deal of interest is being taken in it by the citizens. A strong committee has been appointed to complete arrangements, and Prof. Vincent, has been appointed secretary.

## MONTREAL ELECTRICAL CONTRACTORS ORGANIZE.

Electrical contractors have just formed an association of which the aim is to adjust trade grievances, both general and individual, keep the members informed in regard to trade conditions, raise the standard of electrical construction and in other ways to benefit the members and to improve the special trade conditions. Mr. Sawyer is the first president.

## LONDON C.A.S.E.

The London Lodge, No. 30, C.A.S.E., will hold a banquet in the Masonic Hall on Friday, February 19. Several prominent engineers will attend. These will include Charles Kelley, Chatham, Executive President and W. A. Crockett, Mount Hamilton, Executive Secretary.

## TWENTIETH ANNUAL CONVENTION.

The twentieth annual convention of the Canadian Association of Stationary Engineers will be held in London, on Tuesday, Wednesday and Thursday, July 27, 28 and 29.

## CANADIAN RAILWAY CLUB.

The seventh annual banquet of the club was held in the Windsor Hotel, Montreal, on Friday evening, January 29th. More than two hundred were present, and more than two hundred had a great time—due to the efforts of the Dinner Committee, composed of Messrs. Powell, Wheatley, Purdy, Diamond, Evans and Underwood.

## CANADIAN SOCIETY OF CIVIL ENGINEERS.

The twenty-third annual convention was held in Toronto, on January 28, 29 and 30, for the election of officers, members of Council for 1909 and the transaction of general business.

The report of the council showed a total membership of 2,331, made up of 13 honorary members, 488 members, 692 associate members, 42 associates and 1,096 students, an increase of 363.

On Jan. 29 a visit was made by the members to Port Colborne, where they visited the new government elevator and the works of the Canadian Portland Cement Co. The works of the Plymouth Cordage Co., Welland, were also visited.

Dr. Galbraith, in the president's address pointed out the necessity for preserving our forests and our rivers. He also pleaded for the broader education of the engineer as he played an important part in national development.

At the concluding session George A. Mountain, chief engineer of the Dominion Board of Railway Commissioners, was unanimously elected President of the society, succeeding Dr. Galbraith, dean of the faculty of applied science in the University of Toronto.

Mr. Mountain was born in Quebec in 1860 and was at one time chief engineer of the Canada Atlantic Railway. In 1890 he commenced the surveys of the Ottawa, Arnprior & Parry Sound Railway, which road was completed in 1897. He served as chief engineer of the St. Lawrence & Adirondack Railway until in 1904 he took up the same work with the Dominion Board of Railway Commissioners.

The other officers elected were:—Vice-Presidents, Messrs. W. F. Tye, Col. H. N. Ruttan and G. J. Desbarats; Council, Messrs. J. E. Schwitzer, A. E. Doucet, D. MacPherson, D. A. Ross, N. J. Kerr, R. S. Lea, J. G. Legrand, F. W. W. Doane, C. R. Cantlee, L. A. Vallee and F. P. Gautelius; members of general section, Messrs. F. P. Sherwood and A. St. Laurent; electrical section, Messrs. C. H. Mitchell and L. A. Herdt; mechanical section, Messrs. H. A. Bayfield and W. Kennedy, jr.; mining section, Messrs. F. L. Wanklyn, Charles Fergie and R. W. Leonard.

## OTTAWA BRANCH C.S.C.E.

A branch of the Canadian Society of Civil Engineers has been formed at Ottawa by the members of the society resident in that city. A large attendance responded to the call for the purpose of inaugurating this branch. Mr. Butler, Deputy Minister and Chief Engineer of Railways and Canals; Collingwood Schreiber, consulting engineer to the Government; Mr. Dion, electrical engineer of the Ottawa companies; Mr. Mountain, chief engineer of the Government Railway Commission; Col. Anderson, chief engineer of the Marine Department, and Mr. Coutlee, district engineer of the Georgian Bay Canal Commission, were in attendance and discussed the object of the society. Chas. R. Coutlee was elected president for the ensuing year.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*

*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street
Phone Main 1255
TORONTO - 10 Front Street East
Phone Main 2701
WINNIPEG, 511 Union Bank Bldg.
Phone 3726
F. R. Munro
BRITISH COLUMBIA Vancouver
R. Bruce Bennett
1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C.
Phone Central 12960
J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe
933-935 Monadnock Block
NEW YORK - R. B. Huestis
622-624 Tribune Bldg.
Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas
8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf
Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II FEBRUARY, 1909 No. 2


## CONTENTS


The Power Development at Shawinigan, Quebec. - - 9
Some Considerations of Heat and Cold Insulation - - 15
Course of Lessons for the Instruction of Stationary Engineers - - - - - 18
Complete Line of Belt and Steam Air Compressors - 20
The History and Development of the Steam Turbine - - 22
Fire Doors - - - - - 23
The Distinctive Features of Four-Cycle Gas Engines - 24
Nelson, B.C., Municipal Hydro-Electric Power Plant - - 25
Panels for 240-480 Volts - 26
Distributing Cold Through Pipes 26
Practical Articles by our Readers 27
Curing a Knock.
Pipe Covering in Canada
Pumping by Compressed Air.
Engine Brasses and their Adjustment.
Repairs at Sea.
Boiler Compound Feeder
A Simple Oil Pump.
Exhaust Steam and Condensation Water.
Correspondence - - 32
To Our Readers.
Gas Burner.
Effective Silencers.
One of Many.
Novel Power Plant.
Problem on Friction.
Dusting Electrical Apparatus 32
Societies - - - - 33
Editorial - - - - 34
New Equipment for Power Plants - - - 35
Power Plant Developments - 38


## PRESERVE CANADA'S RESOURCES.

In the president's address to the Canadian Society of Civil Engineers, Dr. Galbraith pointed out that the ambition of the engineering profession should be to conserve and regulate the country's streams and water powers, to maintain our forest growth, to develop transportation facilities and check the extravagance and waste of Canada's natural resources. B. E. Walker, president of the Canadian Bank of Commerce, speaking at the engineering dinner that followed the president's address, showed the duty of the engineering profession. He said: "Our problem to-day is to conserve Canada's wealth. Learn to conserve what we own. If you do, in future centuries Canada will be master of the steel trade and rich in lumber and water powers. All the nations will have to come to her."

So vital and far-reaching a question is the conservation of our natural resources that the Dominion Parliament is giving heed to the problem and a resolution has been unanimously endorsed whereby three standing committees will be appointed to inquire into and report on all matters appertaining to the conservation of our fisheries, forests, mines and water powers. The question is one beyond the pale of party politics and is being approached in a broad and patriotic way.

When it is remembered that not only the timber supply of the future, but the flow of the rivers and artificial irrigation for farming, depend on the forest growth it will be seen the great need of preserving Canada's forests. The duty of both Federal and Provincial Governments is apparent and the steps taken to preserve our resources are timely. The United States has had a national stock-taking and the report showed a waste in productive methods. The Dominion can profit by the experience of our neighbor and preserve hers by both Dominion and Provincial carrying out a practical policy of preservation of our natural resources.

## BUYING COAL BY SPECIFICATION.

Some manufacturers have been complaining that the coal they are getting is of such poor quality that it is increasing the cost of production. We hear the statement that "coal is coal," but an analysis of coal shows that the only way to determine the heating value of coal is by an analysis.

The value of coal varies with the calorific value. For instance, if a manufacturer gets 13,000 B.T.U. per pound of coal at one time and only 11,000 B.T.U. per pound at another, and is paying the same price per ton, he is not getting the same heat units and he is paying a higher price for his coal.

The quality of coal depends on moisture, sulphur and ash. These quantities vary in different coals, and it is only reasonable that coal should be purchased on a basis of the B.T.U. per pound. This is a question for our Government to investigate, and, if necessary, provide for Government inspection of this commodity in order that it may be properly graded and priced according to its heating value. .

## "GOOD ENOUGH" NOT "GOOD ENOUGH."

How many readers have finished a piece of work and said it was good enough? Have you tried it finishing a boiler? Be sure if you did a serious accident would follow. Everything must be done in the best possible manner. Every engineer should live up to this ambition, or sooner or later find himself passed over by one who does his best and does things well—one who takes pains to do things thoroughly. "Good enough" is not "good enough."

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

## SARCO AUTOMATIC COMBUSTION RECORDER.

Complete combustion is the formation of Carbon dioxide (CO2) and therefore a record of the percentage of carbon dioxide in the gases of combustion is a direct indication of the degree of perfection to which the fuel has been burned, and a reliable guide to the efficiency and economy. The "Sarco" Automatic Combustion Recorder is for this purpose and is suspended on a wall, preferably, in the immediate vicinity of the boiler or furnace, to which it is attached, so that the fireman may have it in continuous view, and be enabled to turn to account immediately the information which the machine provides.

A ¾ in. pipe, which taps the side flue or last combustion chamber of each boiler or furnace, is connected to the inlet pipe D of the instrument, and the gas is drawn through the machine by an aspirator P, fixed to the top of the instrument by standard T. A continuous passage of gas is thus secured, rendering it possible to read on the chart the effect of an alteration in the fixing within a few minutes of its occurrence. The power required to procure and deal with the gas samples is derived from a fine stream of water at a head of about 2 or 3 feet. Only 6 to 8 gallons per hour are required.

After actuating ejector P, a portion of the water flows to the tank L, which serves as a pressure regulator and is provided with an overflow tube R. From this tank the water enters tube H in a fine stream, the strength of which is adjusted by the cock S (according to the number of records that may be desired per hour), and gradually fills the vessel K.

Vessel K consists of an upper and a lower compartment, the two being in communication with one another through a tube erected in the upper chamber and reaching nearly to the top of same.

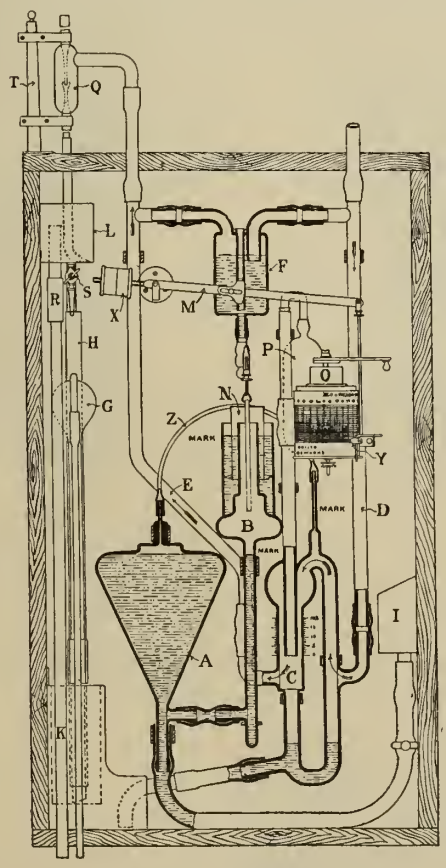
The water, which enters this vessel K through the tube H, gradually fills the upper chamber and thus compresses the air contained in it.

This pressure is transmitted to the lower compartment through the communication tube above mentioned, and here acts upon the mixture of glycerine and water (1 part of the former to 3 of the latter) with which this is filled, driving it out into the calibrated tube C.

While this has been taking place, the aspirator Q has been drawing a continuous stream of gas right through D, C, and E, in the direction indicated by the arrows.

When the rising liquid in C has reached the inlet and outlet to this vessel, no further gas can enter the calibrated tubes for the moment, and the aspirator will now draw the gas through the seal F, and out in the direction of the arrow for the time being.

Before the liquid can close the centre tube in C, the gas has to overcome the




Sarco Automatic Combustion Recorder.

slight resistance offered by the elastic bag P, and is thereby forced to assume atmospheric pressure.

The moment the liquid has sealed the lower open end of this centre tube, exactly 100 c.cm. of flue gas are trapped off in the outer vessel C and its companion tube, under atmospheric pressure.

As the liquid rises further, the gas is forced through the thin tube Z and into vessel A, which is filled with a solution of Caustic Potash at 1.27 specific gravity.

Upon coming into contact with the surface of the potash and the moistened sides of the vessel, the gas is freed from any carbon dioxide that may be contained in the sample, this being rapidly and completely absorbed by the potash.

The remaining gas gradually displaces the potash solution in A, sending it up into vessel B. This has an outer jacket, filled with glycerine and supporting a float N. Through the centre of this float reaches a thin tube, through which the air in B is kept at atmospheric pressure. The float is suspended from the pen gear M by a silk cord and counter-balanced by the weights X.

The rising liquid in B first forces a portion of the air therein out through the centre tube in the float, and then raises the latter.

This causes the pen lever to swing upwards, carrying pen, Y, with it.

The mechanism is so calibrated and adjusted that the pen will travel right to the top, or zero line, on the chart when only atmospheric air is passing through the machine, and nothing is absorbed by the potash in A.

Thus, should any carbon dioxide be contained in the gas sample, it would be absorbed by the potash in A, not so much of this liquid would be forced up into vessel B and the float would not cause the pen to travel up so high on the chart, in exact accordance to the amount of CO-2 absorbed.

The tops of the vertical lines recorded on the chart, therefore, provide a continuous curve showing the percentage of CO-2 contained in the exit gases from the flues, on a permanent diagram arranged for 24 hours.

When the liquid in C has reached the mark on the narrow neck of that tube, the whole of the 100 c.cm. have been forced on to the surface of the potash, one analysis being thus complete.

At this moment the power water, which simultaneously with rising in tube H has also travelled upwards in syphon G, will have reached the top of this syphon, which then commences to flow.

Through syphon G a much larger quantity of water is disposed of than flows in through cock S, so that the power vessel K is rapidly emptied again.

The moment the pressure on this vessel is released, the liquid from C re-

turns into the lower compartment, and float N to its original position.

As soon as the liquid in C has fallen below the gas in and outlets to this vessel, the whole of the remaining gas is rapidly sucked out through E by the powerful ejector Q.

The instrument, once erected, works entirely automatically, and requires no attention beyond changing of the chart and winding of the clock every 24 hours, and renewal of the potash solution every 14 days to 3 weeks.

This instrument is manufactured by Sanders, Rehders & Company, London, England, the Canadian agents being the Canadian Instrument and Testing Company, 17 St. John Street, Montreal.

## POWER TRANSMISSION ARRANGEMENT.

Fitting pulleys to shafts without keys is one of the many applications now possible by the invention of a lathe attachment by Harry Derrer, Superintendent of the Algoma Iron Works, Sault Ste. Marie.

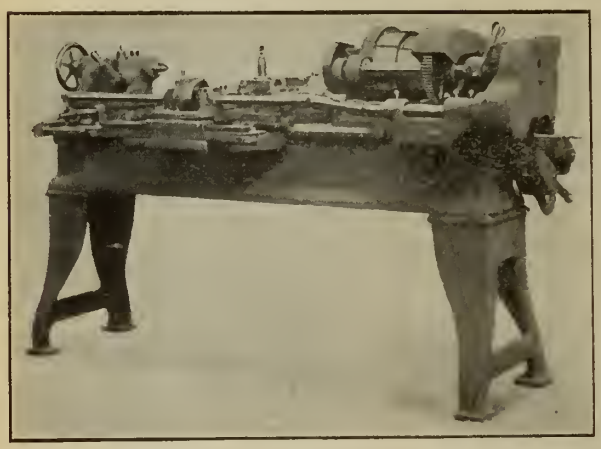


Fig. 1. Lodge & Shipley Lathe fitted with the Derrer Attachment for turning and boring Ovals and Multi-lobe shapes.

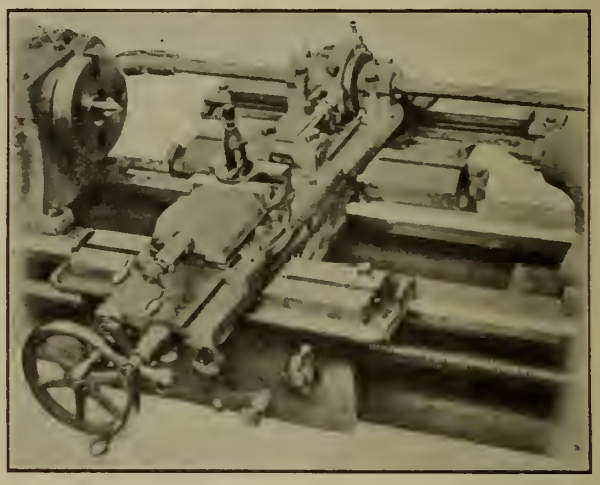


Fig. 2. View of Lathe fitted with Oval and Multi-lobe Turning and Boring Attachment, showing Connection of Cross-slide with Eccentric.

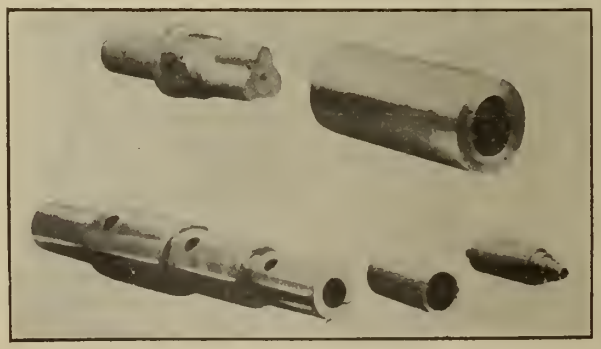


Fig. 3. Samples of Turing and Boring produced by the Attachment.

A Lodge & Shipley lathe with a Derrer attachment for turning multi-lobe shapes is being placed on the Canadia market by the Elevator Specialty Co., Toronto. The patent on the drill sockets is retained by this company but the lathe can be adapted to a great many other uses. For instance, a square hole may be bored in a pulley and the shaft can be turned square to suit the square hole in the pulley. This eliminates the use of a key. If a split pulley is used the shaft can be turned square at the point where the pulley is required and the pulley clamped on it. There is no danger of the pulley working loose.

A shaft may be turned square, oval or eccentric, etc. The gears between the lathe spindle and the attachment may be arranged in the ratio of 1 to 1 for eccentrics, 2 to 1 for ovals, 3 to 1 for 3-lobed cams and 4 to 1 for square sections. Increased ratios may be used for polygams of a greater number of sides.

Examples of the use of the attachments are shown in Fig. 3. These examples include a series of oval taper shank sockets, inserted one within the other, and a 3-lobed coupling joint, which may be used in the same way as the universal joint common in rolling mill practice.

The builders claim that the device is applicable to the making of drives of all kinds, doing away with keys, set-screws, splined shafts and other holding devices. By using the squared design with the ends of the shafts tapered, a square positive coupling drive is procured, free from projecting set-screws and other objectionable features, and one that that can be separated quickly and put together again without the necessity of re-facing.

## DREAMING BUSINESS MEN.

Dreamers are often the butt of scoffers. But there is one thing to be said in favor of the dreamer. He is a thinker.

The trouble with too many men is that they do not think, and the books, the magazines and the newspapers they read are of a kind to entertain and kill time, not to improve their mind or stimulate their ambition and energy. Their associates are of the same class. There would be no heaven for them in the company of thinking people.

Much of the dreamer's thinking may be in the clouds; but it is better to think away up in the "blue" than not to think at all. The great thing is to think right.

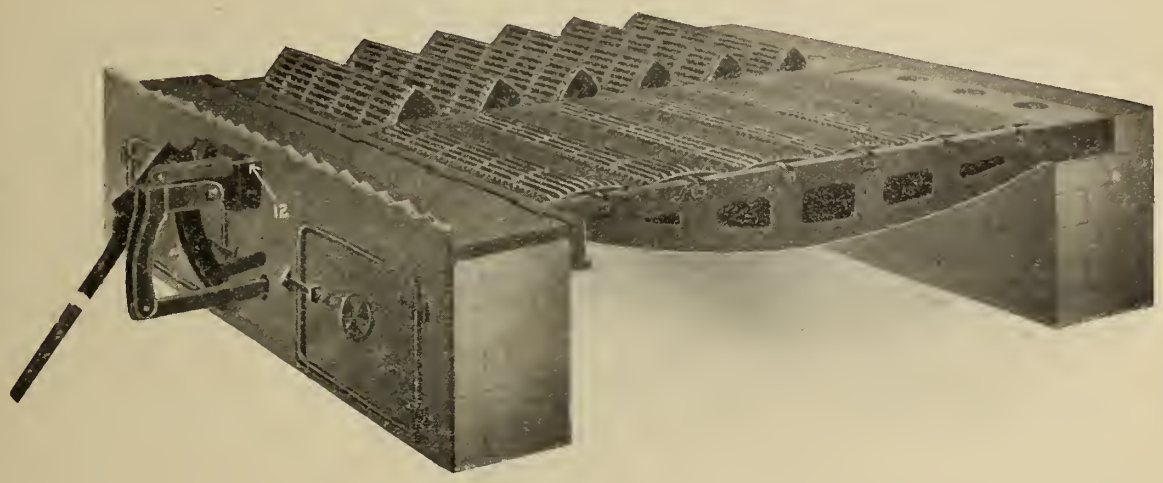
Every business man who has ideas is a dreamer. Dream on, Mr. Business Man, and put your dreams into practical form as soon as possible ere a more energetic man than you who has been having similar dreams steals a march on you.

By all means dream, but at sun rise get busy to make your dreams come true.

The Montreal Harbor Commissioners, in view of the recent harbor enlargements and the proposed new scheme of development, have added to the engineering staff Mr. A. D. Swan, C.E., of Bristol, England.

# The "Diamond" Shaking and Dumping Grate Bar is Perfect in Construction

**No lost motion. No heavy clinkers. No jamming.**



**Easy of operation. A perfect dumping bar. A perfect shaking bar.**

***Will Last a Life Time***

Constructed so that they can be placed under any type of Boiler within a short time. No extensive alterations to brick work.

Will burn any grade of fuel with a minimum of waste. The grate has a greater air space than any other, therefore better combustion.

## *The "Diamond" Grate has no Equal as a Fuel and Labor Saver*

We make a specially heavy Diamond Bar for Steamboats and Malleable Annealing Ovens.

*A post card or personal enquiry will bring a prompt reply.*

**We make a specialty of Boiler Setting and repairs to Boilers**

## *THE DIAMOND GRATE BAR COMPANY*

***Head Office and Factory, Berlin, Ont.***

***Branch Office, 118 St. James Chambers, Toronto.*** ***Tel. M 1342***

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Gas Power Items.

The Glencoe, Ont., municipal council is reported to have awarded to the Colonial Engineering Company of Montreal, Que., the contract for the erection of a gas producer plant of 96 horse-power.

The Guelph Light and Heat Commission have 600 more consumers of gas at present that they had this time last year, and about 600,000 feet more gas is being produced. The price of cooking gas has been reduced to 40 cents per thousand feet.

W. R. Martin who is in charge of the C.P.R. oil-boring operations in the Medicine Hat gas area, announces that gas has been struck at the 1900 foot level and that the flow was estimated at a million and a quarter cub. ft. per 24 hours from an 18 inch well. By morning the flow had developed to 5,000,000 feet by mercury test and to 5,241,966 feet by water test, which latter is considered the most reliable.

J. O. Poland, Pittsburg, general inspector for the Dominion Natural Gas Co., was in Galt for a couple of weeks, making a thorough investigation of the system at that place. Recent disastrous explosions there stirred the company to action, and the inspector is taking drastic measures in Galt. All connections at all faulty are ordered taken out and replaced correctly. The use of rubber tubes as extensions is also condemned, the latter being thought to be responsible for a number of explosions.

## Electrical Notes.

The Canadian Industrial Co., a new pulp and paper concern in British Columbia, propose to develop power on Powell River.

Pembroke ratepayers have approved a by-law to raise $10,000 for the installation of an electric pump, 200 h.p. motor, etc.

The Saskatchewan Government is negotiating with the Bell Telephone Co., re the taking over of that company's lines in Saskatchewan.

The Packard Electric Company's automobile works, which were closed down some time ago owing to trade depression, have started up again.

The Stave Lake Power company will this year spend between $500,000 and $600,000 in construction on their works on the Stave river near Vancouver.

Arrangements are being made by the Lyons Electric Company, Brantford, Ont., to instal a storage battery in its plant. Later on the company expects to duplicate its plant.

Superintendent Hutchison of Victoria, B.C., reports that additional equipment sufficient for 500 new lamps is a necessity for that city's street lighting plant, the present plant working to capacity.

The upper flat of the building of 326 West Craig St., Montreal, occupied by Messrs. Fred. Thomson & Co., contracting electrical engineers, was destroyed by fire, the total damage being estimated at about $15,000, of which $12,000 is to stock.

K. L. Aitken, the Toronto Electrical Engineer, stated that he would be ready to advertise for tenders for the work on the new municipal electrical distribution plant within a few days. The plans for the service have been prepared and the surveys made.

An English company will develop a water power on Adams River, B.C., near Shuswap, to supply the towns of the Okanagan Valley with electric power. The matter has progressed so far that notification has been sent to the different municipal councils that the company is ready to make contracts.

The Hydro-electric Commission are considering the tenders submitted for the electrical equipment of the public power transmission line. Hon. Adam Beck, stated that the tenders of insular equipment had been referred to the Government engineers to be tested, and that no figures or announcement could be given out until the test was concluded and reported upon.

Negotiations opened and are still continuing for the taking over of the plant of the London Electric Company valued at $500,000 by the city in order that the company may not be a competitor of Niagara power. The company have submitted four propositions to the city which are being investigated by Engineer Sifton of the Power Commission and a special committee. The company have intimated that if their plant is not purchased they will bring power from the Cataract Company of Brantford, and compete with the city.

The Egerton Tram Company have an expert electrician from New York, looking over the New Glasgow, N.S., electric lighting plant, with a view of purchasing the same. This plant provides lighting for the towns of Westville, Stellarton and New Glasgow, and many are of the opinion that if the management of the Tram Company had control of the lighting of these towns the citizens would get cheaper light.

The Canadian Westinghouse Company, Hamilton, has, according to report, a good chance to secure the contract for the equipment of the transforming stations and switches for the Hydro-Electric Commission. It is an immense contract, involving $600,000. If the company secures it the 1200 employees of the company, who are now working only forty hours a week, will be put on full time.

A company known as the Electrical Distribution Co. has been formed at Windsor for the purpose of taking and distributing electric power from the Hydro Electric Commission. The officers are: President, John Davis, Windsor; vice-president, George M. Hendrie; secretary-treasurer, W. C. Kennedy, both of Detroit. The new company plans to take 10,000 horse power and claims to have a market for all of it without selling to any concerns within the city limits of Windsor. The tunnel company, the street railways and other users of power outside of the municipality are the prospective consumers. With this 10,000 horse power and the likelihood of Windsor requiring 5,000 for its own use the cost would be considerably below $38 per horse power figure that the government is promising Windsor at present. Detroit manufacturers may also be supplied, but legislation may have to be had in this event.

## Power Transmission Line.

The construction of the line will be started as soon as the weather permits, according to Mr. F. H. McGuigan, the contractor. Three-quarters of the right of way has been secured, and the laying of the footings will commence in March. Some five miles of footings each sixteen feet square will be laid prior to putting up the first towers.

## National Electric Compound.

A New York company manufacturing the National Electric Compound for preserving electrical machinery has opened a branch in Canada with head office at 141 Bannatyne Ave., Winnipeg. R. W. Buettner has been appointed manager for Manitoba, Alberta and Saskatchewan, and Chas. R. Bassage has been appointed city demonstrator for Winnipeg.

## Goold, Shapley & Muir Co.

The annual meeting of travellers of this company was held in Brantford, on January 22nd, when matters in connection with the firm's business were discussed. The company has decided to extend its business and with this in view W. H. Whitaker, secretary of the company is in Great Britain appointing local agents. He will visit Argentine Republic and other countries in South America. Before leaving he was presented with a pair of cuff links by the travellers on the evening of their banquet, January 22nd.

## Listowel Lighting Plant.

Listowel Council have engaged Messrs. Mitchell Consulting Engineers, Toronto, to prepare estimates on the cost of a municipal lighting plant with cost of maintenance and revenue. P. H. Mitchell has inspected the water pumping station which consists of one boiler of 100 h.p., one engine of 70 h.p. and one generator of 35 h.p. He recommends that steam be utilized and that the present plant be duplicated. Messrs. Mitchell will submit estimates for 200 to 250 tungsten lights for the street lighting. These with a system of commercial lighting will make the system very complete. A by-law will be submitted to the people for the sanction of the lighting scheme. The approximate cost will be $13,000.

## St. John Waterworks.

The water and sewerage department of St. John, N.B., has construction work now in progress for a larger and more effective water supply, which will require additional water supply pipes. Much has been done to improve the water supply by enlarging and improving the whole system. The old wooden pipes have to a great extent been removed and replaced by supply pipes imported from England.

St. John, during last year, spent about $50,000 on construction of new mains, and about the same amount for material and labor, in the maintenance of its water system. It is not a large city, and its population has been practically stationary for a generation past. Thus little building is going on and public improvements are not extensive, but there was an imperative need of improving its waterworks system, which had become so inadequate that there was danger of a repetition of the great conflagration which practically wiped out the city in 1877. Thus the work was undertaken section by section and is still going on, and it must be some time before the city will be in possession of a modern, up-to-date waterworks system.

# Power Supply Markets

## British Columbia.

A tin smelter in the immediate neighborhood of Victoria will be the next development work on Vancouver Island. This will be built by the Pacific Tin Mining & Smelting Co., a local concern which was incorporated on Jan. 14th of this year, and means to commence work at once. While it will be a few miles from town, it will be so near that all trade will be tributary and will mean much to the city.

The Victoria Machinery Depot were awarded the contract for castings for Victoria. Contract for fire hydrants was awarded to Hutchinson Bros.

Sealed tenders properly indorsed will be received by the Minister of Public Works at Victoria, B.C., for the erection and completion of a bridge across the Columbia River. Tenders are also being called by the Provincial Government at Victoria for wrought and cast iron, per pound, for all the iron work for the above bridge.

The Schaake Machine Works, New Westminster, is receiving a large number of enquiries for the Cowie gasoline engine, and is preparing an illustrated catalogue for distribution.

Prospects are bright for the establishment of several new mills and factories on the banks of the Fraser River at New Westminster. It is probable that Brooks-Scanlon will erect three large sawmills on the Fraser River, two in the neighborhood of new Westminster.

Col. Tracy, of Vancouver, has completed the plans for a new sewerage system for Revelstoke, which will cost $100,000. The central portion will be constructed at present, and others as necessity may require.

## Winnipeg Market.

Tenders will be received for Electrical Machinery, etc., until March 1, by George W. Robinson, Secretary-Treasurer, City of Lethbridge, for a municipal power plant. Bids are wanted on the following: A, boilers and necessories; B, economizer; C, feed pumps; D, mechanical draft; E, pipe work and valves; F, steam turbine generator; G, steam engine generator; H, re-erection of steam engines; I, condensing sets; J, cranes; K, switchboards, etc.; L, motor generators and transformers; M, building steel work, etc. Smith, Kerry & Chance, Engineers, Toronto, Ont.

Tenders are also called for the city of Saskatoon, Calgary, and many other western cities

for municipal plants for lighting and waterworks. Contracts have been let for Winnipeg's transmission line and power equipment. Prospects are very bright through the west for power equipment.

January proved to be a very satisfactory month, with power supplies in the west. The volume of business was satisfactory.

LUBRICATING OILS—600 W. cylinders, 80c; Maple Leaf cylinder, $1 per gal.; 700 A. cylinder, 75c; Sterling cylinder, 55c; 600 A. cylinder, 50c; Capital cylinder, 59 and 54c; Solar red engine, 32c; Atlantic red engine, 29c; heavy castor, 21c; medium castor, 26c; Ruddy harvester, 28c; standard gas engine oil, 36c; Renown engine oil, 38c.

GASOLINE—Engine gasoline, gal., 22½c; f.o.b. Winnipeg, cases, $2.50.

## Toronto Market.

Many Toronto supply houses are figuring on contracts for both Ontario and western Canada and prospects are very bright for some good contracts coming to Toronto firms. There is activity among some engineers who have charge of municipal plants now under construction or contemplated and the manufacturers of power machinery will soon reap the benefit of the large number of contemplated municipal power plants for both lighting and water supply.

Toronto is proceeding with the work on the distributing system and the first of the equipment is now being tendered for. The city system must be completed by Dec. 19, 1909.

BOILER TUBES—Orders are now increasing with prices steady. The following prices are quoted per 100 feet: 2-in., $8.50; 2½-in., $10.50; 3-in., $12.50; 3½-in., $15, and 4-in., $18.

LEAD WOOL—$10.50 per 100 lbs., $200 per ton.

OILS—Prices are stationary with business showing signs of increasing. Factories generally are running with more machinery and more hands than a few months ago, with a result that there is an increased demand for lubricating oils.

## Montreal Market.

OILS—The prices in lubricating oils for this district remain unchanged. The market is stiffening up, and the immediate outlook is bright. January's business this year was, however, only slightly better than last year, but nevertheless better. It shows a strong tendency to increase. This is due to a better feeling throughout the trade, and the fact that mills and factories are becoming busier every day.

The current prices (February 5th) are as follows:—Cylinder oils (imp. gal.) 60c to 80c; engine oils, 30c to 60c; machine and dynamo oils, 30c to 45c; shafting oils, 25c to 40c; lubricating greases (per lb.), 8c to 12c.

BOILER TUBES.—The condition of the market continues on the same level as last month. The demand is becoming more brisk. The prices are practically constant, although the prices on American tubes show a tendency to rise. The German and English firms are still placing their product on the Canadian market at prices below those at which the tubes sell at home. The question regarding tariff on steel entering the United States has a bearing on Canadian trade conditions, because the big buyers are withholding orders pending the tariff decision. This makes the conditions slack and as there are no steel tubes manufactured in Canada, the boiler trade here reflects that of the United States. Prices are as follows: 2 in. tubes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

BOILER ACCESSORIES—The January business in these lines has generally exceeded that of last year by a good margin. Some makers declare they are back to the normal condition of 1906, which speaks volumes. In this line, buying is generally slack anyway at this time of year as there is comparatively little or no building going on. Prices are steady.

## BOOK REVIEWS.

POCKET BOOK—Practical Engineer Pocket Book and Diary for 1909, issued by the Technical Pub. Co., 55 and 56 Chancery Lane, London W.C., Eng., 789 pages. Price, 1s. net; leather, gilt with diary on ruled section paper, 1s. 6d. net. This is the twenty-first issue of this pocket book and is a great aid to the engineer, designer and operative in their every-day duties. Among the additional subjects included are the new Board of Trade Rules for the manufacture of materials intended for Boilers; notes on the effect of Vacuum in Condensers; Dimensions of Standard Bends, Tees and Pipe Flanges; Chain Driving; Limit Gauge Work, etc. Among the other subjects treated are Mechanical Stokers, Boilers and accessories, steam and gas engines, gas producers, oil engines, etc. The book is full of information for the engineer in charge of power plants.

THE BOILER, by Stephen Christie; Christie Publishing Company, Chicago. This book was written by a practical master boiler maker who has treated the subject from the shop standpoint. As a help to the man in the shop who "wants to know" regarding the rules governing the construction of boilers, this book is to be recommended. The author has worked out a great many examples and none can fail to follow the mathematics, so that engineers contemplating taking examinations would find this book an assistance.

STEAM BOILERS: (second edition), by Cecil H Peabody and Edward F. Miller; John Wiley & Sons, New York. Price, $4.00. A clearly written book in which the subject is well handled. Confusing mathematics are eliminated while the principles of boiler mathematics have not been slighted. Students in technical colleges would find this book instructive and it should be a useful addition to the libraries of engineers in general. The appendix contains a compilation of very useful tables pertaining to steam and steam-boilers.

## CATALOGUES.

SWING GATE VALVE—From Walch & Wyeth, 87 Lake St., Chicago, describing the various uses of the Erstwood Swing Gate Valve for back pressure, safety gate, non-return between cylinders and condensers, safety relief on air lines of compressors, etc.

TRANSFORMERS—Circular 1157 from Canadian Westinghouse, Hamilton, entitled Westinghouse Type "S" Distributing Transformers. The transformer is fully described in detail.

WATER FILTERS—From Hungerford & Terry, Fifteenth and Chestnut Sts., Philadelphia, describing mechanical filtration and pressure filters.

GAS ENGINES AND GENERATORS—From Allis-Chalmers-Bullock, Montreal, bulletin 1063 describing in detail their gas engines from 300 to 5,000 h.p. and A.C. and D.C. generators.

THERMIT REPAIRS—From Goldschmidt Thermit Co., 103 Richmond St. W., Toronto, illustrating repairs made by the thermit process. These include motor case, truck frames, rails, cylinders, connecting rods, motor armature shaft, gear wheels, flywheels, etc.

HIGH STEAM PRESSURES IN LOCOMOTIVE SERVICE—Is the subject of a bulletin just issued by the University of Illinois Engineering Experiment Station. It is an abstract of a report upon the same subject, which was published last year by the Carnegie Institution of Washington, D.C., and summarizes the results of one hundred locomotive tests conducted by Dr. W. F. M. Goss under the patronage of the Carnegie Institution in co-operation with the authorities of Purdue University.

RUBBER PACKING—From The Gutta Percha and Rubber Mfg. Co., 47 Yonge Street, Toronto, booklet P.1 giving descriptions and packings for piston rods, rubber pump valves, sheet rubber packing and gaskets.

RUBBER HOSE—Booklet H-1, from The Gutta Percha & Rubber Mfg. Co., 47 Yonge St., Toronto, describing woven cotton covered steam hose, wire wound steam hose, pneumatic tool hose, mill fire hose and fittings.

RUBBER BELTING—From The Gutta Percha & Rubber Mfg. Co., 47 Yonge St., Toronto, booklet B.1, giving information regarding the manufacture of rubber belting. A number of rules for finding the width and length of belts required, etc., are included. Illustrations are shown of a number of elevators using rubber belting.

GRAB BUCKETS—54-page illustrated catalogue on heavy bond paper from Brown Hoisting Co., Cleveland, Ohio, describing grab buckets for handling coal, ore, limestone, etc.; double and single rope buckets, automatic dumping tubs, shovel buckets, etc.


**Factory for Sale**

Large factory on Lachine Canal, near the city; about 8,000 square feet of floor and 20,000 square feet of ground, with water power. Close to G. T. R., C. P. R. and boats. Apply to L. E. Godin of McAvoy, Lemieux, Dupre & Godin, 4 St. Lawrence Boulevard, Montreal. 4-09

**City of Saskatoon**

PROVINCE OF SASKATCHEWAN

**Tender for Pumping Machinery**

SEALED TENDERS will be received by the City Clerk until

**8 P.M. on February 24th, 1909.**

for furnishing and erecting one Pumping Engine with a capacity of 1,200 to 1,500 U.S. gallons per minute.

For further particulars address the Chief Engineer.

WM. HOPKINS, ESQ., Mayor of Saskatoon, Sask.

J. H. TRUSDALE, ESQ., Secretary-Treasurer, Saskatoon, Sask.

WILLIS CHIPMAN, C.E.,
Chief Engineer,
103 Bay Street,
Toronto, Ont.

**WATER POWER**

By J. P. Frizell

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

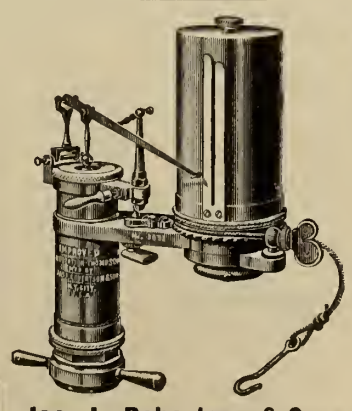
658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**

TECHNICAL BOOK DEPARTMENT

**10 Front St East - - Toront**



**Jas. L. Robertson & Sons**

38 Warren St., New York

**WHAT ARE YOU DOING**

towards advancement in your profession?

**A ROBERTSON-THOMPSON INDICATOR**

will push you forward quicker than in any other way. Easy price and terms.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non advertisers.**

### Air Chambers.
Hercules Float Works, Springfield, Mass.

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

### Boiler Feed Regulators.
Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boiler Mountings.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boilers.
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Castings, Brass.
Hercules Float Works, Springfield, Mass.

### Combustion Recorder.
Canadian Instrument and Testing Co., Montreal.

### Condensers.
Goldie & McCulloch Co., Galt.

### Consulting Engineers.
Bain & Mitchell, Montreal
De Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Samuett, Montreal.
J. M. Shanly, Montreal.

### Coppersmiths.
Hercules Float Works, Springfield, Mass.

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Damper Regulators.
Peiler & MacKenzie, Montreal

### Dynamos.
Electrical Maintenance & Repair Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Electrical Repairs.
Electrical Maintenance & Repair Co., Toronto.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Automatic.
H. W. Petrie, Toronto.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

### Engines, Gas and Gasoline.
Gas & Electric Power Co., Toronto.
Gould, Shapley & Muir Co., Brantford
J. DeClercy, C E., Montreal.

### Engines, High Speed, Steam.
Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantf ord

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Engines, Simple and Compound.
Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

### Engines, Vertical.
H. W. Petrie, Toronto

### Exhaust Heads.
Standard Engineering Co., Toronto.

### Feed Water Analyser.
Canadian Instrument and Testing Co., Montreal.

### Feed Water Heaters
Brownell Co., Dayton, Ohio
Goulds Pump Co., Montreal.
Peiler & MacKenzie, Montreal

### Flanges
Dart Union Co., Toronto

### Floats, Seamless, Copper.
Hercules Float Works, Springfield, Mass

### Gas Producer Plants.
Bain & Mitchell, Montreal
Gas & Electric Power Co., Toronto.

### Gauges, Pressure, Vacuum and Recording.
Peiler & MacKenzie, Montreal

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Grates.
Canadian Steam Boiler Equipment Co., Toronto
J. DeClercy, Montreal

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Grease Cups.
Peterboro Lubricator Mfg. Co., Peterboro

### Hangers.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Heaters.
Goldie & McCulloch Co., Galt.

### Indicators, Steam Engine.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Mechanical Stokers.
Jones Underfeed Stoker Co., Montreal

### Meters, Water and Electric.
Peiler & MacKenzie, Montreal

### Mill Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Motors.
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Panels, Electric
Hill Electric Switch Co., Montreal

### Pipe Threading Tools.
Borden-Canadian Co., Toronto.

### Planimeters.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.
Goldie & McCulloch Co., Galt
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

### Power Transmission Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Pump Governors.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt.

### Safety valves.
Peiler & MacKenzie, Montreal

### Shafting.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Special Machinery.
Electrical Maintenance and Repair Co. Toronto.

### Steam and Oil Separators.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Steam Pumps.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

### Steam Specialties.
Jas. Morrison Brass Mfg. Co., Toronto
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.
Peiler & MacKenzie, Montreal

### Stocks and Dies.
Borden-Canadian Co., Toronto.

### Switches, Electric
Hill Electric Switch Co., Montreal

### Switchboards, Light and Power.
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co., Montreal

### Tanks, Oil.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford

### Tests and Inspections.
Bain & Mitchell, Montreal

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Turbine Water Wheels.
Jenckes Machine Co., Sherbrooke, Que.
Jas. Morrison Brass Mfg. Co., Toronto.
J. C. Wilson & Co., Glenora, Ont.

### Unions
Dart Union Co., Toronto

### Vacuum Regulating Valves.
Peiler & MacKenzie, Montreal

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Watt Meters.
Gas & Electric Power Co., Toronto.

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**

**Executive Secretary**

**MT. HAMILTON, - ONT.**

# THE BIG THREE in ELECTRICITY

**Franklin Discovered It—Edison Developed It—The Cyclopedia Applies It**

CYCLOPEDIA *of*

## APPLIED ELECTRICITY

**is a practical guide for every man who wants information regarding electrical appliances. This work presents in compact, practical form and in simple, non-technical language, the results of the best work of the best men in the electrical profession; it lays the foundation of electrical progress for years to come.**

**THE YOUNG MAN** who has not yet chosen his life's work, will find it a valuable guide to one of the greatest money making professions of the present and future age. The development of this vast science has just begun. There is plenty of room at the top for inventive genius and new discoveries that will bring fame and fortune.

**THE ELECTRICAL WORKER,** whether "trouble shooter" or expert, will find this Cyclopedia especially valuable as an index to what he knows and a ready reference to what he has forgotten.

**THE BUSINESS MAN AND HOUSE OWNER** can gain from it a knowledge of electricity that will save him many a dollar.

This Cyclopedia covers the whole electrical field more completely than any other group of volumes. It comprises 2,896 pages of up-to-date, authoritative information; it treats of 23 general subjects; its detailed index includes over 4,000 different topics. It contains hundreds of special photographs, diagrams, sections, etc., besides condensed tables and formulas, containing information that it would require years of time and a fortune to collect. The pages are 7x10 inches in size, printed on special paper, in large, clear type, carefully bound in half morocco.

***FREE FOR EXAMINATION***—Fill in and mail the coupon. We will send you a set of these practical books for five days' FREE examination. Examine the books carefully. If satisfactory, send us $2.00 within five days and $2.00 per month until you have paid the special $18.60 price. The regular list price is $36.00. If you don't keep the books, advise us and we will send for them. **Remember!** You can examine the books without expense or obligation—we pay all express charges.

IMPORTANT SUBJECTS COVERED

Theory, Calculation, Design and Construction of Generators and Motors; Electric Wiring; Electric Telegraph; Wireless Telegraphy; Telautograph; Types of Dynamos and Motors; Elevators; Direct Current Motors; Direct-Driven Machine Shop Tools; Electric Lighting; Electric Railways; Alternating Current Motors, etc.; Single Phase Electric Railway; Management of Dynamos and Motors; Power Stations; Central Station Engineering; Storage Batteries; Power Transmission; Alternating Current Machinery; Telephony; Automatic Telephone; Wireless Telephony, Telegraphone, etc.

FREE! IF YOU ORDER PROMPTLY

With all orders received before March 1st, we will include for one year, as a monthly supplement, the

TECHNICAL WORLD MAGAZINE

An ideal American family monthly - regular price $1.50. Clean, instructive, helpful and true—with the whole round world as its field. Present day, scientific facts and inventions are treated in a manner so clear and comprehensive that any one can understand and every one can learn.

"WHO OWNS THE EARTH?" The strongest and most instructive serial ever published began in the January issue. We will include both the January and February numbers.

**AMERICAN SCHOOL OF CORRESPONDENCE**
**CHICAGO, U.S.A.**

FREE OFFER COUPON

American School of Correspondence:

Please send Cyclopedia of Applied Electricity for FREE examination: also T.W. for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60, otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

POWER HOUSE—2—09

# ALPHABETICAL INDEX TO ADVERTISERS


A

American School of Correspondence ... 41
Audel & Co., Theo. ... 5

B

Bain & Mitchell ... 48
Beaubien, De Gaspe ... 48
Brownell Co ... 1

C

Canada Metal Co ... 45
Canadian Association of Stationary Engineers ... 41
Canadian Instrument and Testing Co ... 43
Canadian Steam Boiler Equipment Co ... 7

D

Dart Union Co ... 7
Death & Watson ... 48
De Clercy, Jules, C.E. ... 47, 48
Diamond Grate Bar Co ... 37

E

Electrical Maintenance & Repair Co ... inside back cover

F

Farmer, John T ... 48
Francis, Walter J ... 48

G

Garde, John, & Co ... 47
Gas & Electric Power Co ... 2
Goldie & McCulloch Co ... 8
Goodhue, J. L., & Co ... 5
Goold, Shapley & Muir ... 3

H

Hercules Float Works ... 47
Hill Electric Switch Co ... 48

J

Jenckes Machine Co ... 3
Jones Underfeed Stoker Co ... 1

K

Kerr Engine Co ... 47
Kilmer, Pullen & Burnham ... inside back cover

Mc

McAvoy, Lemieux, Dupre & Godin ... 39
McLaren, D. K., Ltd. ... 4

M

Mitchell, C. H. & P. H ... 48
Morrison Brass Mfg. Co., Ltd., Jas ... outside back cover

P

Packard Electric Co., Ltd ... 42
Parke, Roderick J ... 48
Peiler & MacKenzie ... 6
Penberthy Injector Co., Ltd ... outside front cover
Petrie, H. W ... 6

R

Rae, J. B ... 48
Robb Engineering Co ... 2
Robertson, Jas. L., & Sons ... 39
Robertson, J. M ... 48

S

Sadler & Haworth ... 5
Sammett, M. A ... 48
Saskatoon City ... 39
Shanly, J. M ... 48
Sight Feed Oil Pump Co ... 1
Standard Engineering Co ... 47

T

Technical Books ... 44
Toronto Plate Glass Importing Co ... 47

W

Waterous Engine Works Co ... 1
Wilson, J. C., & Co ... 47


# Condensed Advertising

**RATES**

One insertion—25c. for 20 words; 1c. a word for each additional word.

Yearly rate—$2.50 for 20 words or less; 10c. a word for each additional word.

## DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Machine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. The "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

## ELECTRIC LIGHTING.

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

## MISCELLANEOUS.

NOTICE—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator, and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts for the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ontario.

THE RELIABLE LIGHT will light your store 100 better than gas, electricity or acetylene. 600 candle power light costs 1 cent per hour to operate. Thousands in use. A safe, reliable, pure white light of intense brilliancy. Write for booklet M. The Rice-Knight Mfg. Co., Limited, 40 Lombard Street, Toronto.

# Incandescent Lamps

Packard

The Old Reliable
Used Everywhere

*All Standard Candle Powers and Voltages.*

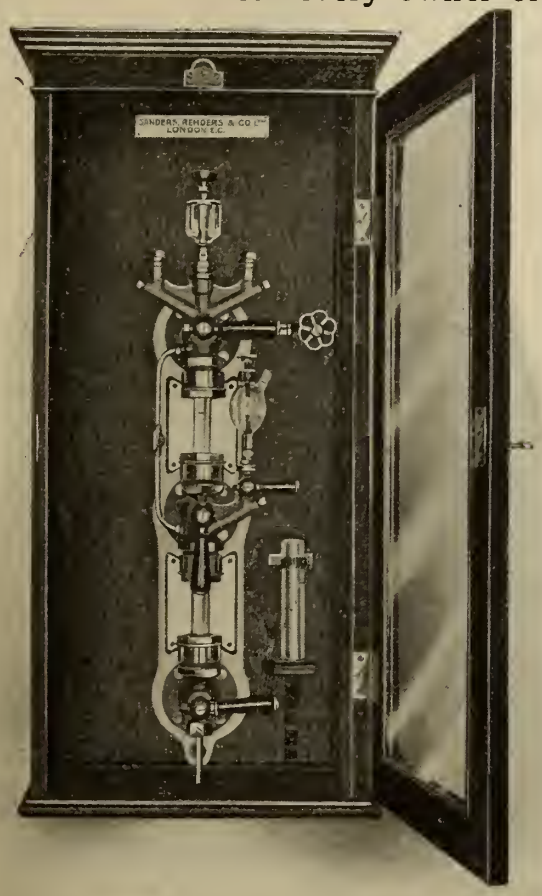
# The Packard Electric Co., Limited

Head Office and Works: St. Catharines, Ont.

Branch Offices:
Montreal
Winnipeg

# Instruments that positively SAVE MONEY

for every owner of a Steam Power Plant.



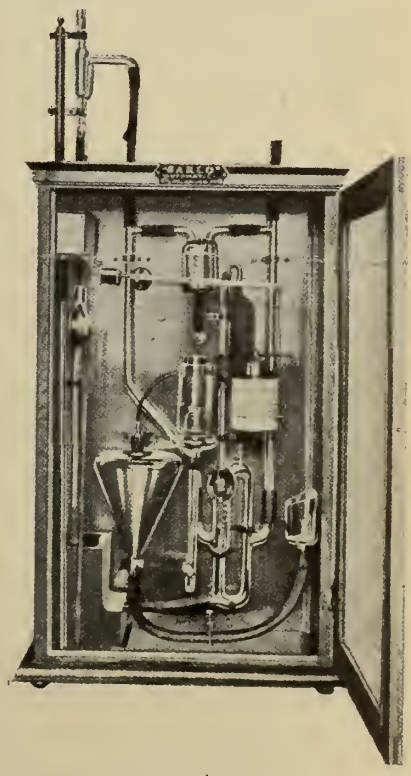

## Boiler Scale Prevention

is one of the toughest problems you have to face as the owner of a steam boiler. It is well known that Soda is the best preventative of Boiler Scale; the difficulty has been to know the right quantity to apply to the feed water. Thus more or less elaborate water softening plants often fail to prevent scale formation. But the problem has now been satisfactorily and inexpensively solved by the invention of the

# "SARCO"

## Feed Water Analyser

a small and simple instrument which analyses your feed water from day to day, infallibly indicating the exact amount of soda necessary to absolutely prevent the formation of scale in your boilers. We positively guarantee SARCO FEED WATER ANALYSER to give an absolutely correct analysis of any feed water to which it is applied.



## You Lose Money on Incomplete Fuel Combustion;

and if you had an instrument that would automatically tell you every hour just exactly how near perfectly your fuel was burning, you would save a lot of money; because "fore-warned is fore-armed." It would enable you to make provision to get a hundred cent's worth of combustion for every dollar's worth of fuel shovelled into your boiler furnace. There is such an instrument !—the

# "SARCO" Combustion Recorder

It automatically analyses the exit gases created by fuel combustion, and indicates upon a chart, in plain view all the time, the exact percentage of carbon dioxide which that gas contains. 20% Carbon Dioxide (C O 2) indicates practically complete combustion. Consequently the farther your furnace is from effecting complete combustion the more it is up to you to STOP THE WASTE.

Full particulars and prices sent immediately upon request.

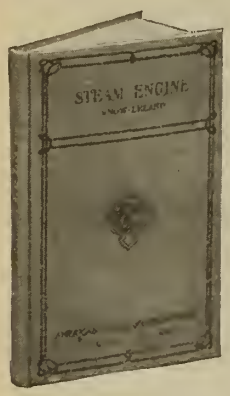
# Canadian Instrument and Testing Co.

Montreal - - Canada

# PRACTICAL BOOKS FOR ENGINEERS

(All Orders Payable in Advance)

## The Steam Engine



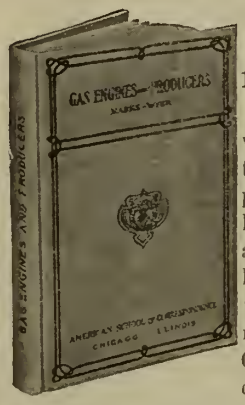

By W. B. Snow and W. S. Leland.

Price $1.00 Postpaid.

150 Pages. - - - 63 Illustrations.

This practical manual is for the use of Engineers, Firemen, Machinists, Oilers and Shopmen in general. It deals with Principles of Operation, Types of Engines fitted for different kinds of work, the Steam Turbine, Multiple Expansion Engines, Engine Accessories, etc. All are clearly explained in a way that anyone can grasp.

## The Gas Engine in Principle and Practice




By A. H. Goldingham.

Price $1.50 Postpaid.

195 Pages. - - - 107 Illustrations.

This new, up-to-date volume by a well-known expert is an able exposition of the gas engine and producer plants. It gives clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with descriptions of the various designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc.

## Electric Wiring and Lighting

By C. E. KNOX, E.E., and G. C. SHAAD, E.E.,
(Consulting Electrical Engineers).

192 Pages. Price $1.00. 150 Illustrations.

A practical guide to approved modern methods of lighting by electricity and of installing conductors for the transmission and utilization of electricity for power, lighting, heating and other uses. Regular price $1.50, but special price for the present is $1.00.

## Dynamo Electric Machinery

By F. B. CROCKER, E.M., Ph.D.,
(Head of Electrical Engineering Dept., Columbia University).

256 Pages. Price $1.50 Postpaid. 260 Illustrations.

A complete and authoritative treatise on the theory, constructive details, calculation and design of dynamo-electric machinery, including such important subjects as Armature Winding, the Determination of Characteristic Curves, etc.

## Valve Gears and Indicators

By W. S. LELAND, S.B., and C. S. DOW, S.B.,

150 Pages Price $1.00. 105 Illustrations.

Two Books in One. A clear and full explanation is given of details too seldom understood by enginemen themselves, but absolutely necessary to the efficiency of the engineer on a locomotive or a stationary engine of the reciprocating type. The following are dealt with: Types of Valves, Gears and Indicators, Link Motion, Use of Valve Diagrams, etc.

## Refrigeration

By CHAS. DICKERMAN, Refrigerating Engineer, Pennsylvania Iron Works, and
FRANCIS H. BOYER, Constructing Engineer.

128 Pages. Price $1.00 Postpaid. 60 Illustrations.

A complete guide to the principles and mechanical details and practice of modern systems of artificial cooling, including the construction, equipment and operation of various types of refrigerating plants, such as ammonia compression and absorption, brine, compressed air, carbonic anhydride, etc.

Further information regarding the above books or others on kindred subjects given on application to

**Technical Books, 10 Front St. East, Toronto**

## Not "Just as Good"

but—

## A Great Deal Better

# HARRIS
# HEAVY PRESSURE BEARING METAL

Casts a Perfect Bearing. Positively Eliminates Friction to a Minimum. Will not Break or Crack in Bearing. For Quality and Durability There is No Equal. For Sale Everywhere.

*Manufactured by*

## The Canada Metal Company Limited
**Toronto**

# SLOW PROGRESS

Not much use in creeping along at a tortoise pace when easily acquired knowledge will take you along much faster. There's valuable information between the covers of the books listed below that ought to be in your head. Here is a chance for you to get practical books worth from fifty cents to three dollars each absolutely free. To any subscriber sending in one new paid-up subscription to the Power House we will give the books in Offer No. 1; for two new paid-up subscriptions the book in Offer No. 2; and for three new paid-up subscriptions the book in Offer No. 3.

## Offer No. 1

**Value $1.00**

ENGINEERS' ARITHMETIC
By Colvin & Cheney.

An arithmetic specially arranged for the Stationary Engineer. Shows how to work the problems of the engine-room and shows "why." Has steam tables and a lot of other useful information that makes it popular with practical men.

PRACTICAL GUIDE FOR FIREMEN
By W. H. Wakeman.

Containing instructions and suggestions for the care and management of steam boilers, pumps, injectors, traps and gauges.

## Offer No. 2

**Value $2.00**

HAWKINS' NEW CATECHISM OF ELECTRICITY
By N. Hawkins, M.E.

A thoroughly practical book by an acknowledged authority, dealing with the theory and practical application of electricity in its various branches. Positively invaluable to the engineer who is interested in the great modern motive force.

## Offer No. 3

**Value $3.00**

TWENTIETH CENTURY HANDBOOK FOR STEAM ENGINEERS AND ELECTRICIANS.
By C. F. Swingle, M.E.

A practical compendium of useful knowledge concerning the management of Steam Engines, Boilers and Dynamos, with full instructions for making evaporation tests on boilers. 780 pages, 400 illustrations, handsomely bound in full leather, pocket-book style. Size, 5x6 1-2x1 inch thick.

**Send in the required number of new subscriptions and you will receive the book to which you are entitled by return mail.**

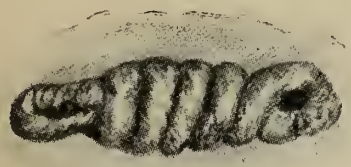
# THE POWER HOUSE

**10 Front Street East, Toronto**

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

**OPAL GLASS TILING**
FOR WALLS OF
**MACHINERY AND POWER HOUSES**
Most approved material.
**TORONTO PLATE GLASS IMPORTING CO'Y.**
PLATE AND WINDOW GLASS
135 to 143 Victoria St., - Toronto

**250,000**
**Hercules**
**Seamless Copper**
**Floats**

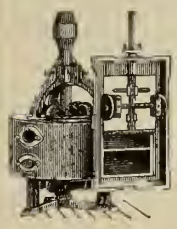
**are in use to-day.**

That speaks pretty well for their reliability, doesn't it? Be on the safe side, and use Hercules Floats.

Catalog "C" sent on request.

**Hercules Float Works**
P.O. Box 396. Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**



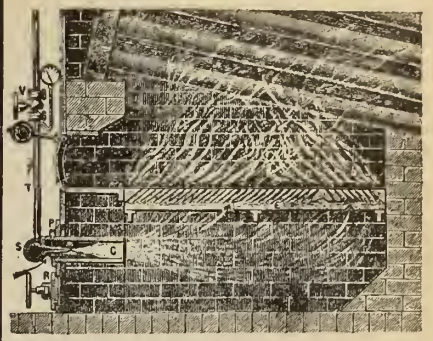
Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effiei-ency at full or partial gate opening.

Construction, acme of simplicity.

Unequalled durability.

Write for descriptive cat-alog.

**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.



# Saves Money! Cheap Power!

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

Saves 20% to 50% in your fuel bills.

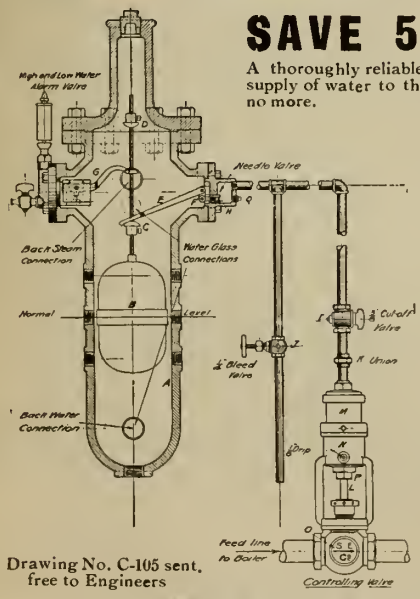
*For Particulars Apply*

**J. de Clercy, C.E.**
62 Ontario St., West
MONTREAL

# STANDARD AUTOMATIC BOILER FEED REGULATORS

## SAVE 5% IN FUEL

A thoroughly reliable machine that regulates the supply of water to the boiler just as required, and no more.




Drawing No. C-105 sent, free to Engineers

Maintains a constant level of water in the boiler, within one half inch from where wanted. Gives you the maximum space for steam.

Saves expansion and contraction due to hand feeding.

Made of the best materials and built interchangeably on the Universal system.

All valves can be removed for inspection while boiler is in operation.

Absolutely prevents explosions due to low water.

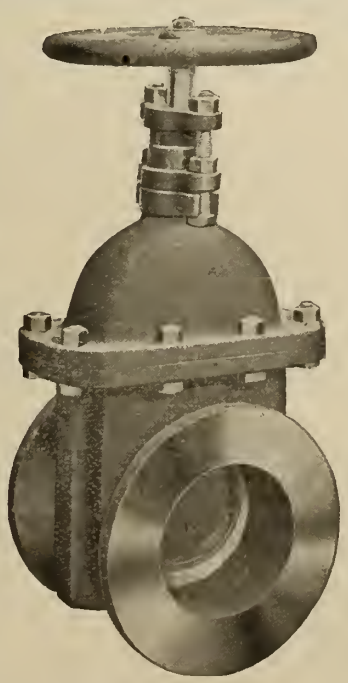
Few and simple parts, therefore reliable in operation.

***A Necessity on Every Boiler.***

SEND FOR DESCRIPTIVE PAMPHLET—FREE ON REQUEST.

**The Standard Engineering Company**

STEAM SPECIALTIES DEPARTMENT
234 Coristine Bldg., MONTREAL, P.Q.
43 Scott Street, TORONTO, CAN.



# *KERR GATE VALVES*

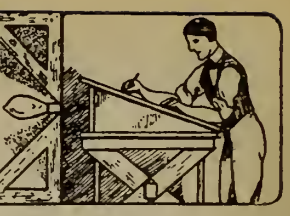
***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

***The Kerr Engine Co., Limited***
***Valve Manufacturers***
***Walkerville, - Ontario***

# PROFESSIONAL DIRECTORY




**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**JULES DE CLERCY, M.E.**
GAS ENGINEER
Expert knowledge of all classes of Engines and Producer Plants. If you are thinking of installing a Gas Engine or Producer Plant write me. If your plant is not working satisfactorily I can help you.
62 Ontario St. West, - MONTREAL, QUE.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**RODERICK J. PARKE**
A.M. Can. Soc. C.E. A.M. Amer. Inst. E.E.
Consulting Electrical Engineer
INDUSTRIAL STEAM AND ELECTRIC POWER PLANTS DESIGNED, TESTS, REPORTS
205 Yonge St., Bank of Toronto Bldg., TORONTO
Long Distance Telephone—Office and Residence

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

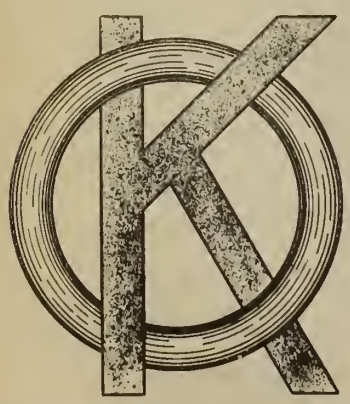
*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Estimates, Reports, Plans and Specifications. Supervision of Power. Lighting and Railway Installat
Liverpool London and Globe Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS' BANK BUILDING, TORONTO

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**BAIN & MITCHELL**
CONSULTING and CONTRACTING ENGINEERS
SPECIALTIES—Marine, Stationary, Hydraulic, Engines, Boilers, Steam Power Plants, Reports, Tests, Inspections, Plans Specifications, Valuations and General Drawing Office Work.
SOLE CANADIAN AGENTS
Hawkins' Imperishable Jointing Cement.
Mansfield's Patent Oil Gas Apparatus.
The Ackroyd-Buckley Patent Steam Superheater.
The Keighley Gas & Oil Engine Co.
Uptown 2526
Y.M.C.A. Bldg., MONTREAL

**CONSULTING AND SUPERVISING ENGINEERS**
You should have your card appear regularly on this page—you may miss important engagements by not being represented



**IS THE VERDICT FROM COAST TO COAST**
On Each and All **Hill Electric Outfits**
***WHY?***

***BECAUSE*** they are made by experts in the best equipped factory in Canada. Each part made by jigs and dies, thus ensuring its being interchangeable.

If you need Switch Boards, Panels, Cabinets, etc., drop us a line. Send us a sketch—we'll do the rest, that's our business.

**The Hill Electric Switch Co., Ltd., 1560 St. Lawrence Boulevard, Montreal**

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419

# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

The Trade Mark ***J. M. T.*** is representative of QUALITY in Engineers' Brass and Iron Goods.

Our products are made to give that lasting satisfaction so essential in goods of this kind.

The experienced engineer knows it to be poor judgement to use these goods simply because they're cheap.

Valves of All Kinds in Iron and Brass

Iron and Brass Cocks—Steam, Marine and Asbestos Packed

J. M. T. Improved Y Blow-off Valve, with renewable seat

Steam, Vacuum and Combination Gauges

Revolution Counters

Engineers' Clocks

Improved Recording Gauges

Steam and Hot Water Thermometers

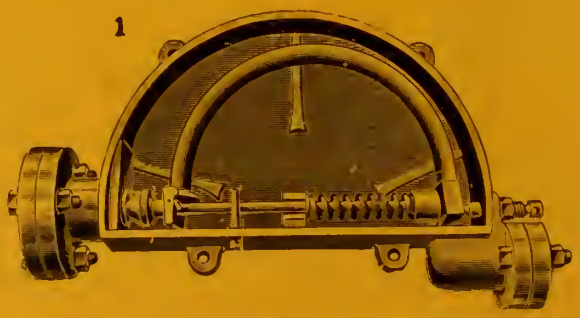
# Engineers' Supplies

## and Steam Specialties

*Improved*
***J.M.T. Injector***

operates under the widest range of pressures.

SIMPLE
EFFICIENT
RELIABLE



***The "HEINTZ" Steam Saver***

Controlled by temperature, operates under any pressure, can be placed in any convenient location, contains few parts which are easily accessible to.

The ***Heintz Trap*** combines great efficiency and durability, has large capacity and operates at a variation at one degree of temperature.

*Booklet upon request*

***J.M.T. Valves***

They require no introduction. Used anywhere where a good valve is required.

Look for Trade Mark on all J. M. T. Valves.

## The JAMES MORRISON BRASS MFG. CO., Limited

**93-97 Adelaide Street West** **TORONTO**

CIRCULATES IN EVERY PROVINCE OF CANADA

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. II. Publication Office, Toronto — March, 1909 No. 3

TRADE PENBERTHY MARK.

The Only Injector That Satisfies

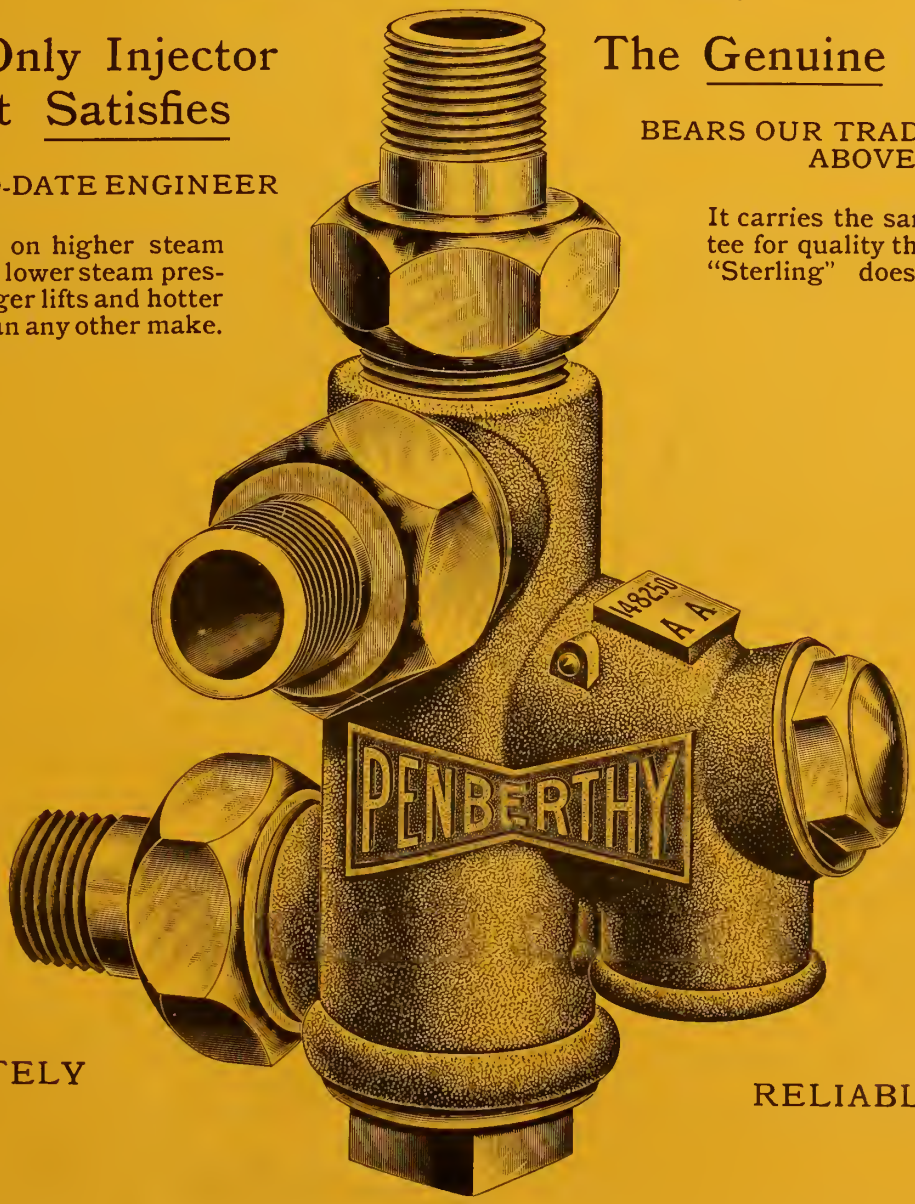
THE UP-TO-DATE ENGINEER

It works on higher steam pressure, lower steam pressure, longer lifts and hotter water than any other make.

The Genuine Penberthy

BEARS OUR TRADE-MARK AS ABOVE.

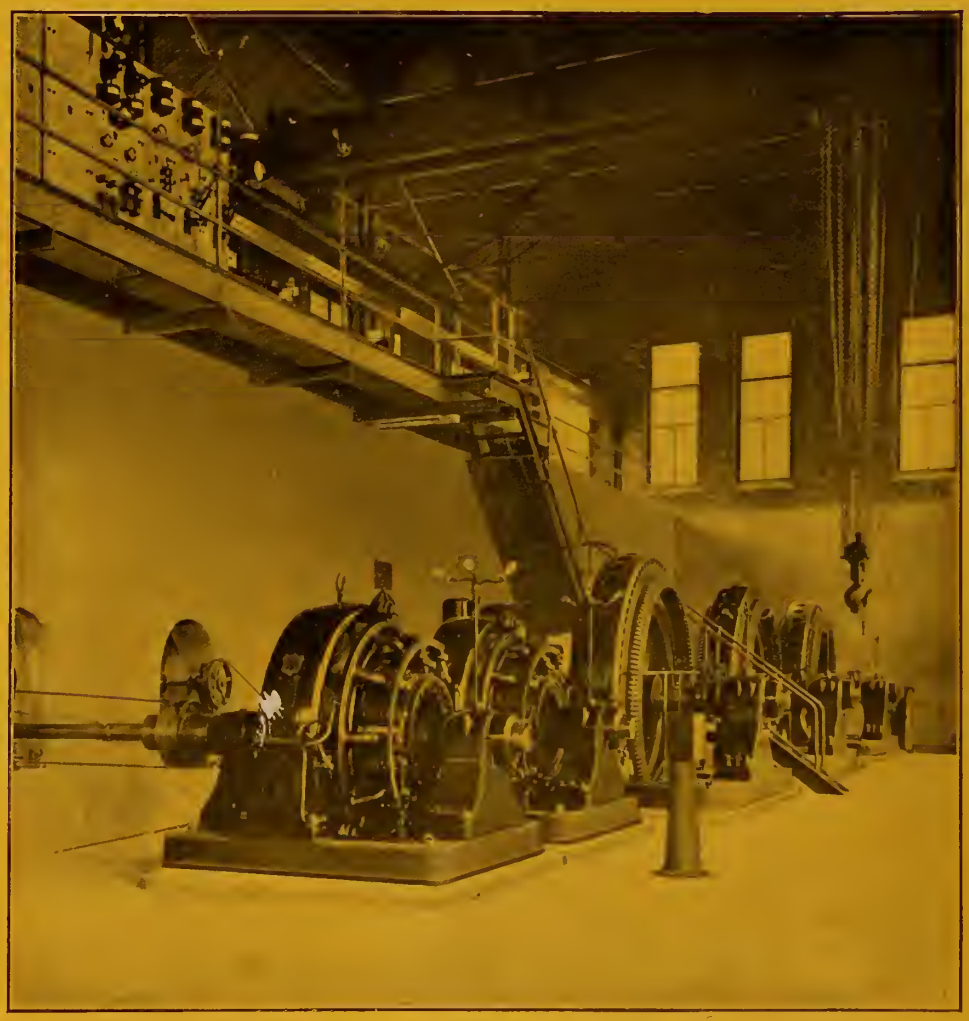
It carries the same guarantee for quality that the word "Sterling" does on silver.




ABSOLUTELY RELIABLE

# HYDRO-ELECTRIC PLANTS

OF ALL CAPACITIES



**POWER HOUSE, KENORA, ONT.**

Three of our 625 K.W. water wheel type alternating current generators, exciters, switchboard and other auxiliary apparatus in the power house of the town of Kenora.

Send for Bulletin 303, describing hydro-electric plants.

Send for Bulletin 1050, describing water wheel type alternators.

## ALLIS-CHALMERS-BULLOCK

LIMITED

**Works : Montreal**

**Sales Offices : New Glasgow, Montreal, Toronto, Cobalt, Winnipeg, Calgary, Vancouver**

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units

Specially Suited for Direct Connected Electrical Works.

Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

BRANTFORD, - ONTARIO

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

On Account of their Extremely Low Cost of Operation and the Small Amount of Attention Required

## Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

## Goulds Pump Co.

Coristine [illegible] Montreal

Phon[illegible]n 1654

*Works - - - - - - Seneca Falls, N.Y.*

## The Brownell Company

Dayton, - Ohio

Branch Offices:

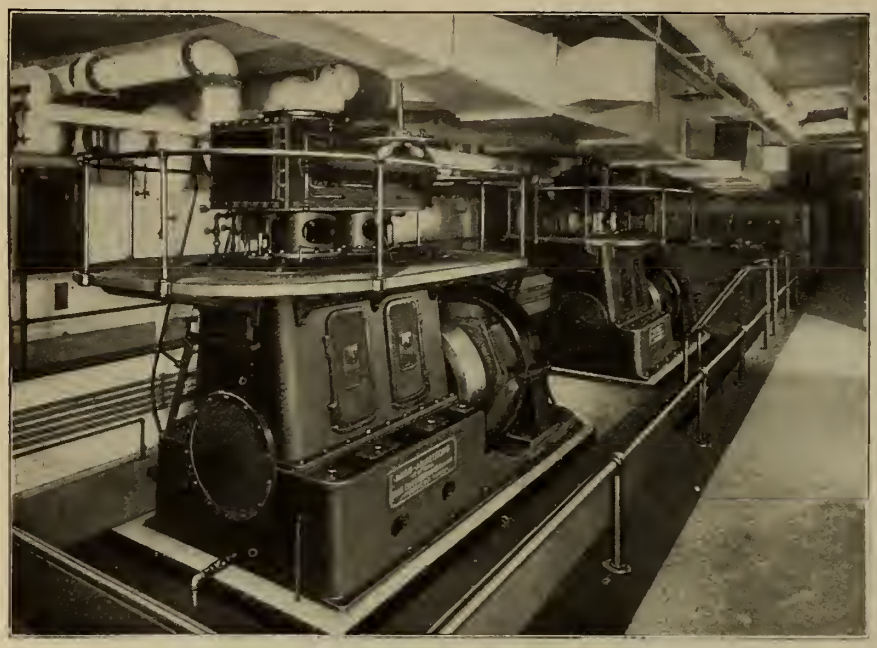
401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.



# HIGH SPEED VERTICAL ENGINES

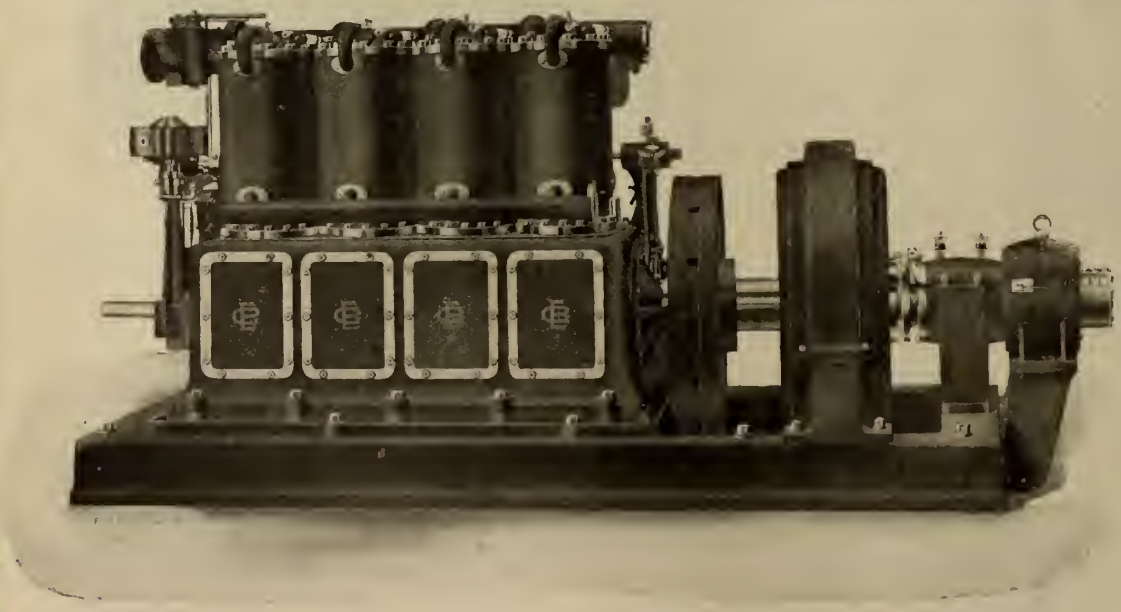
of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES { Traders Bank Building, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
Union Bank Building, WINNIPEG ; J. F. Porter, Manager

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants  Pressure Gas Plants



Engine direct connected to alternators, guaranteed to run in parallel successfully.

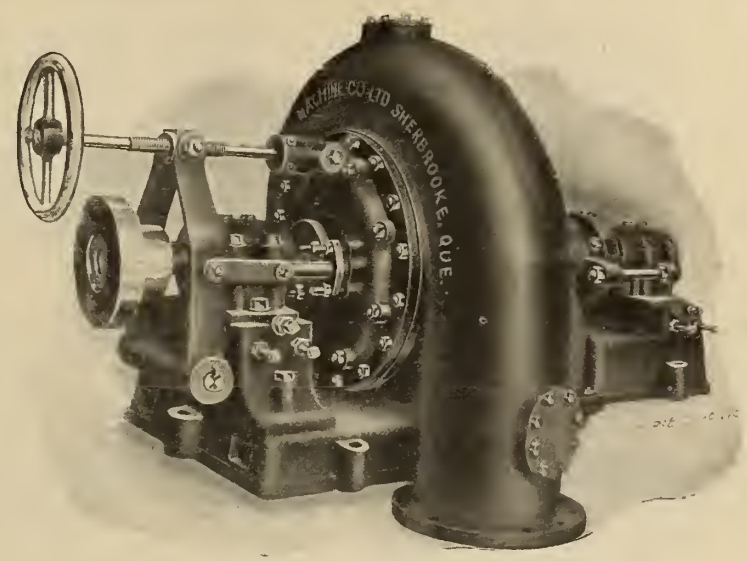
Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.
**Stair Building, Bay Street - TORONTO**

For High Heads we recommend our Niagara Type Turbine in spiral case.

We have a number of them in operation, including three at Niagara Falls and all are giving full satisfaction.




Ask for copy of bulletin No. 202.

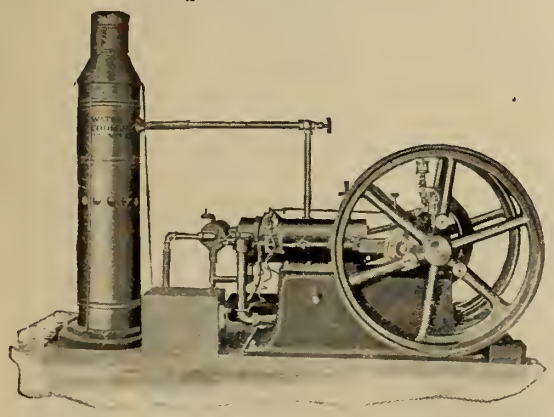
## The Jenckes Machine Company, Limited

Sherbrooke St. Catharines Cobalt Vancouver Halifax

Works : Sherbrooke, Que. ; St. Catharines, Ont.

## GAS and GASOLINE ENGINES

1½ to 25 H.P.

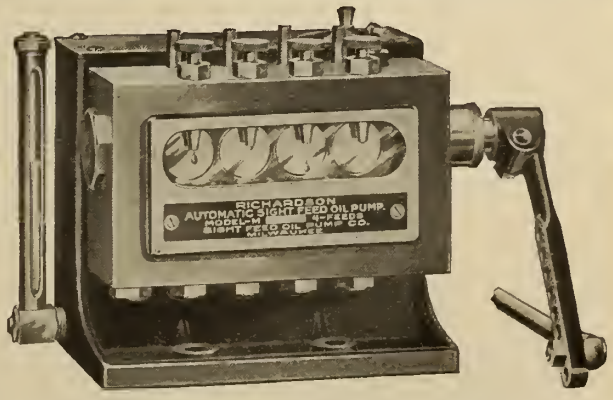


If interested it will pay you to write for our Catalogue

**Goold, Shapley & Muir Co.**
Limited

BRANTFORD - CANADA

## The Model "M" Method




You would not shoot at a flock of birds with a rifle! You would not sow seed with a shovel! A rushing stream of steam will not efficiently charge itself with oil that is introduced spasmodically in quantities, and the oil that is introduced is only partially effective; a large percentage dodges right on thru the engine and is lost.

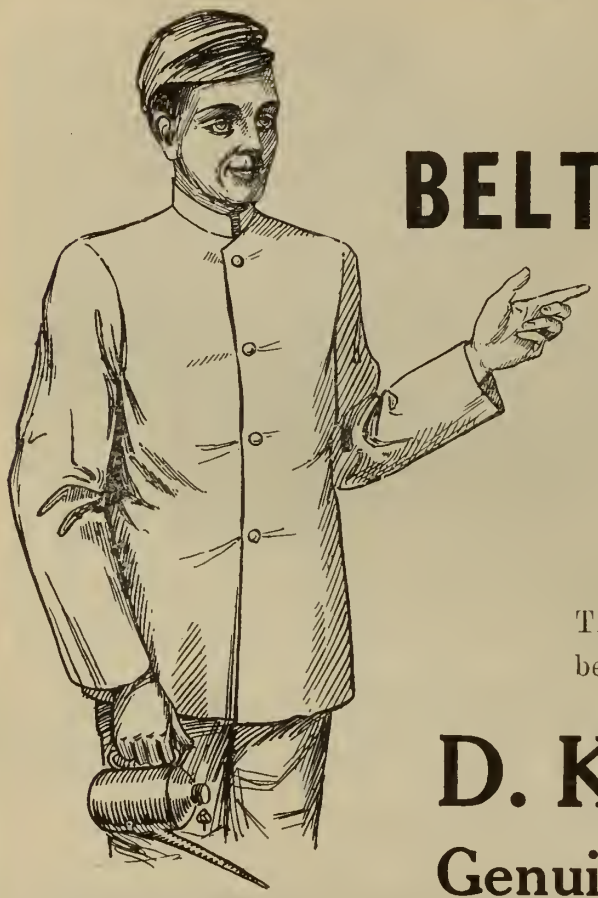
The Model "M" Method is to introduce a less amount of oil in very small quantities at every engine stroke. It is an interesting story, and we would like to tell you all about it.

Bulletin No. 109-L.

Manufactured by

**SIGHT FEED OIL PUMP CO.**

MILWAUKEE, WIS., U.S.A.



This Trade Mark

is really the best

# BELTING INSURANCE

There is a big difference between some belting and **D. K.** McLaren's belting.

## D. K. McLaren, Limited

## Genuine British Oak Tanned

# LEATHER BELTING

is made only from backs. Our tanning process is the real British Oak Tanning Process which produces belting that can always be relied upon. Our regular line is

## "Extra C"

Our special lines made only to order are

**"Waterproof Cement"**
Gives greatest satisfaction in Laundries, Bleacheries, Breweries, etc.

**"Giant Crusher"**
The heaviest Drive made, for Cement Plants, Crushers, etc.

**"Special Mule"**
Heavy Grade, single only. In substance and durability it exceeds a light double.

*WRITE FOR PRICE LIST*

# D. K. McLAREN, LIMITED

MONTREAL
309-311 Craig Street West

TORONTO
200 King Street West

QUEBEC
21 St. Peter Street

ST. JOHN, N.B.
64 Prince William Street

WINNIPEG
Fred. J. C. Cox & Co., Representatives

VANCOUVER
418 Abbott Street

Full stock of our "Extra C" Leather Belting and "D.K." Balata at above addresses.

# A Morse and Dexter Improved Valve Reseating Machine

TO STEAM USERS:

You have all experienced the annoyance, trouble and expense caused by **Leaky Steam Valves.**

The **Improved Morse and Dexter Reseating Machine** will repair **in position** any size or make of steam valve.

No special skill required to operate this machine.

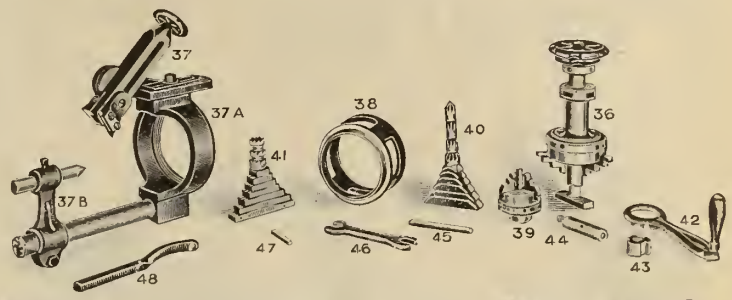
The universal chuck on the Morse and Dexter will fit any valve.

No grinding of valve seats after using this machine.

Guaranteed to make any valve perfectly steam tight.

Furnished on thirty days' trial.

IF INTERESTED, WRITE FOR PAMPHLET "D."




**Darling Brothers, Limited,** Head Office and Works, **2-4 Ottawa St., Montreal**

TORONTO WINNIPEG

# "ACME WATERPROOF" LEATHER BELTS

Stand up to their work under the most trying conditions of running in damp or wet places. They are carefully made by long experienced experts who are thoroughly aware of essentials needed in waterproof belts.

Don't be persuaded against your better judgement, into buying a cheap belt. **Cheap** belts are costly propositions and are expensive in the long run. Take our word for it, we **know** because it's **our business** to know so why should **you** experiment now, only to buy the best in the end?

There are none better than our belts and we **can prove** it. If you are having trouble from belts in wet places, try ours. After putting them on you forget they ever existed, as far as hearing of trouble from them is concerned.

**LET'S TALK IT OVER.**

## J. L. GOODHUE & CO.

**Danville, Que.**

# OAK LEATHER BELTING

The prime factor in belt making is good hides. Our own agents gather the hides used in our belts from all parts of the world.

We use only the best parts (the centers) of the trimmed hides.

SADLER & HAWORTH

FACTORIES

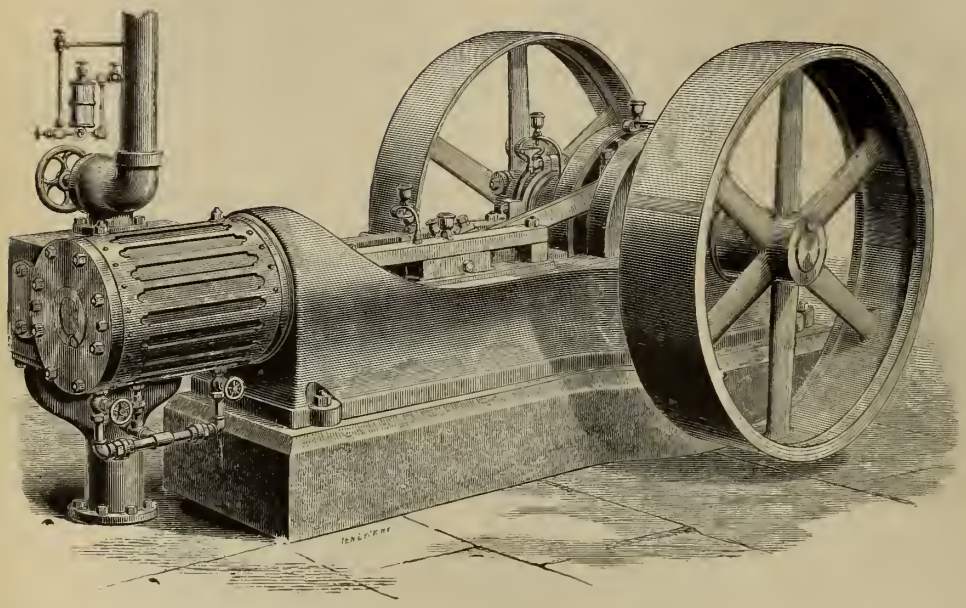
MONTREAL TORONTO

BRANCHES ST. JOHN, N.B. WINNIPEG

BRANCHES CALGARY VANCOUVER

After choosing the hides it is important to have the very best tannage. We use the old-fashioned long method (taking five to six months), which is the only satisfactory way of tanning leather for belting. We fully guarantee our belting.

# Power Equipment



Automatic Engines
Horizontal Engines
Marine Engines
Vertical Engines
Fire Box Boilers
Horizontal Boilers
Marine Boilers
Vertical Boilers
Hoisting Engines
Gasoline Engines
Electric Motors
Water Wheels

Our supply catalogue or machinery stock list for the asking

## H. W. PETRIE, Limited

TORONTO MONTREAL VANCOUVER

---

It is not what you pay for an article, but what the article pays you in return for its cost, that determines its value.

We represent Manufacturers of

## Reliable Engineering Specialties

and solicit enquiries

(Genuine) **ASHTON** Pop Valves, Relief Valves, Gauges, etc.

**MASON** Reducing Valves, Pump, Damper, Pressure and other Regulators.

BERRY Boiler Feed Control
BAT Water and Electrical Meters
POWERS Automatic Temperature Regulation
BUNDY Steam Traps for all Services
OSBORN'S Famous Mining and Tool Steels

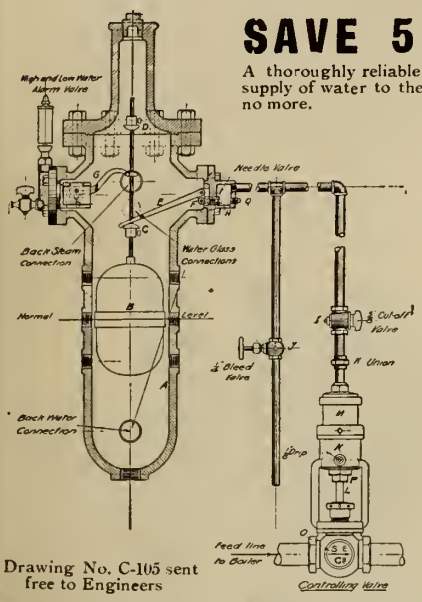
All just a little better than the best.

If we can be of service, write us for particulars.

We are glad to furnish catalogues.

**PEILER & MacKENZIE,** 17 St. John St., **Montreal**

# STANDARD AUTOMATIC BOILER FEED REGULATORS




## SAVE 5% IN FUEL

A thoroughly reliable machine that regulates the supply of water to the boiler just as required, and no more.

Maintains a constant level of water in the boiler, within one-half inch from where wanted. Gives you the maximum space for steam.

Saves expansion and contraction due to hand feeding.

Made of the best materials and built interchangeably on the Universal system.

All valves can be removed for inspection while boiler is in operation.

Absolutely prevents explosions due to low water.

Few and simple parts, therefore reliable in operation.

Drawing No. C-105 sent free to Engineers

***A Necessity on Every Boiler.***

SEND FOR DESCRIPTIVE PAMPHLET—FREE ON REQUEST.

**The Standard Engineering Company**

STEAM SPECIALTIES DEPARTMENT

234 Coristine Bldg., MONTREAL, P.Q.

43 Scott Street, TORONTO, CAN.

# DART'S PAT. UNIONS AND FLANGES

are the most economical

**Because** ( They never require attention.
( They never leak.
( They are always serviceable.

The only union with the all bronze ground ball joint and malleable ends.

"DART'S PAT." is cast on every one.

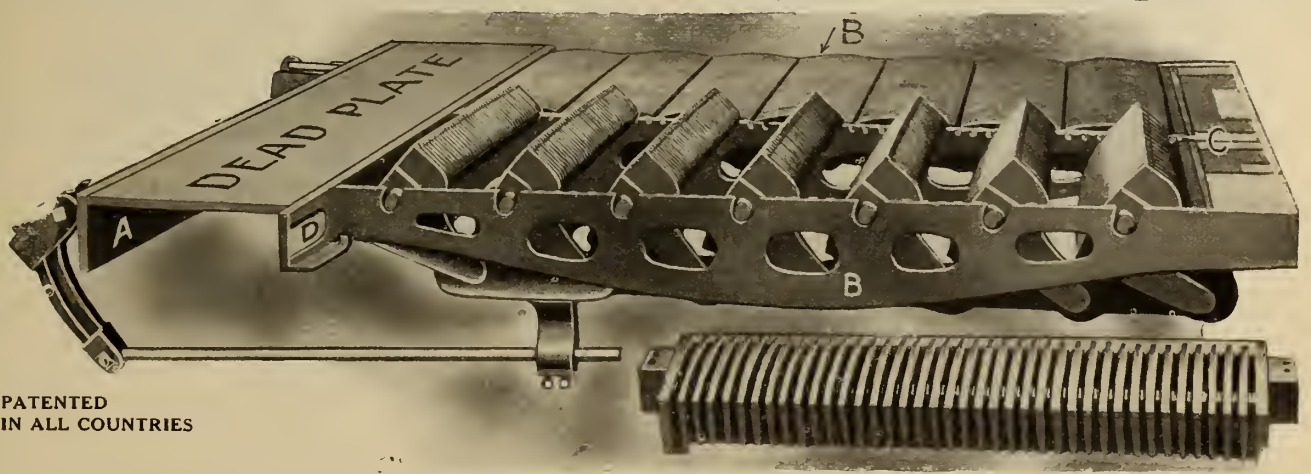
*ALL DEALERS*

# Dart Union Co., Ltd.

Factory—93-97 Niagara St.

TORONTO, - ONTARIO

# The Improved Cyclone Shaking and Dumping Grate




PATENTED IN ALL COUNTRIES

The section of the grate shown nearest the reader is in the Dumping Position; that in the rear is shown level, or ready for the fire. In shaking, the bars are rocked backward and forward slightly, so as to sift the fine ashes through only.

## What we claim for the Cyclone Shaking and Dumping Grate.

A Perfect Shaking Grate. The fire always clean.
A Perfect Dumping Grate. Clinkers Dumped without pulling them out on the floor.
Greater Air Space than any other grate on the market; therefore—perfect combustion.
Perfectly balanced; therefore easy to operate in shaking or dumping.
Will burn any kind or size of coal or wood on the market; either hard or soft, lump or slack, good or bad, therefore—great economy.
Great simplicity of design and strength of parts; therefore—long life.
Easily and quickly installed; therefore—no shut down of plant necessary. No expensive changes in the brickwork needed.
Will effect a saving in the fuel bill of from 5 to 20 per cent. in any plant.
Guaranteed to last longer than any other bar manufactured.

**Is being used by nearly all of the larger concerns in Canada.**

**All Infringements will be Vigorously Prosecuted.**

# CANADIAN STEAM BOILER EQUIPMENT CO., LIMITED

36 and 38 Lombard Street, - TORONTO

# Heavy Duty Goldie Corliss Steam Engines

Designed for Belt or Rope Drive and Direct Connection

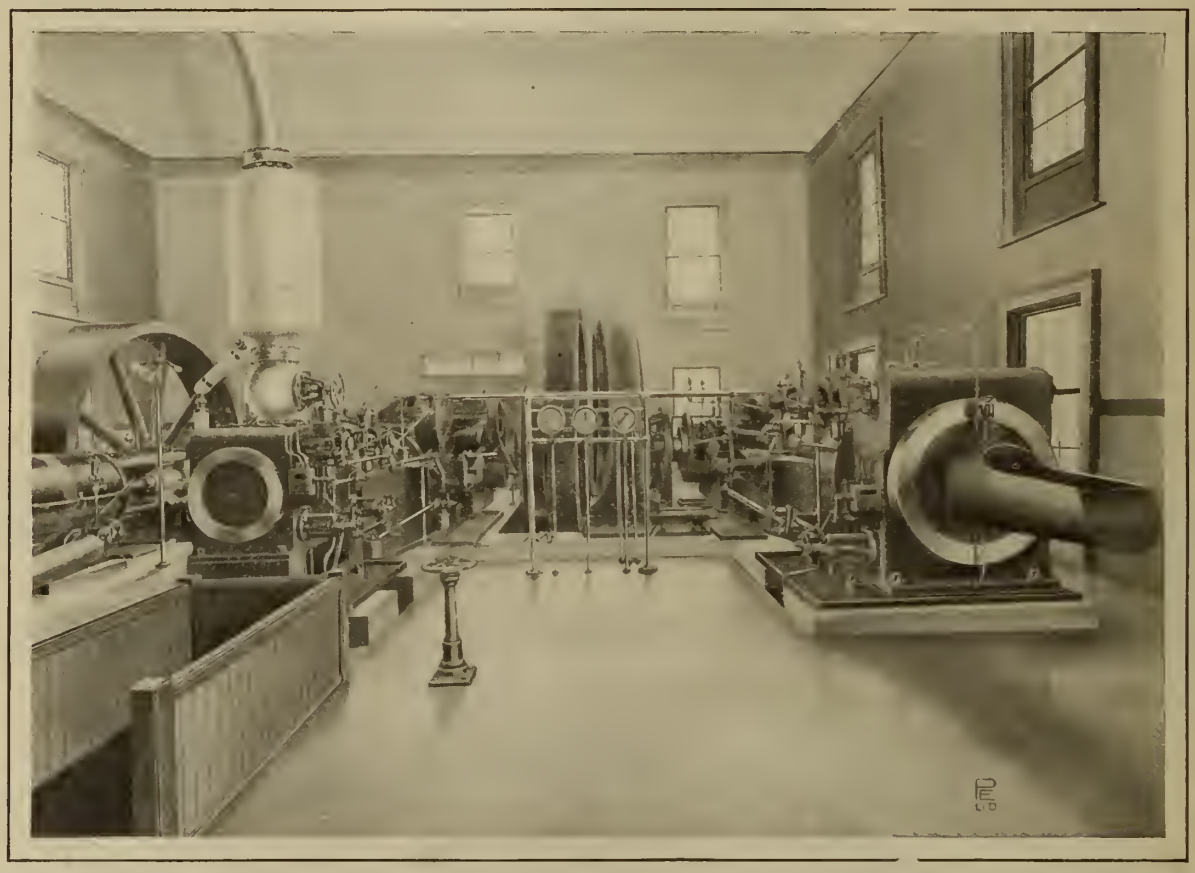


Illustration shows the Power House of the Galt, Preston, Hespeler and Berlin Street Railway, equipped with Cross-Compound Goldie Corliss Engine and Heavy Duty Wheelock for Reserve.

Catalogues and Estimates Cheerfully Furnished

## The Goldie & McCulloch Co., Limited

Galt - Ontario - Canada

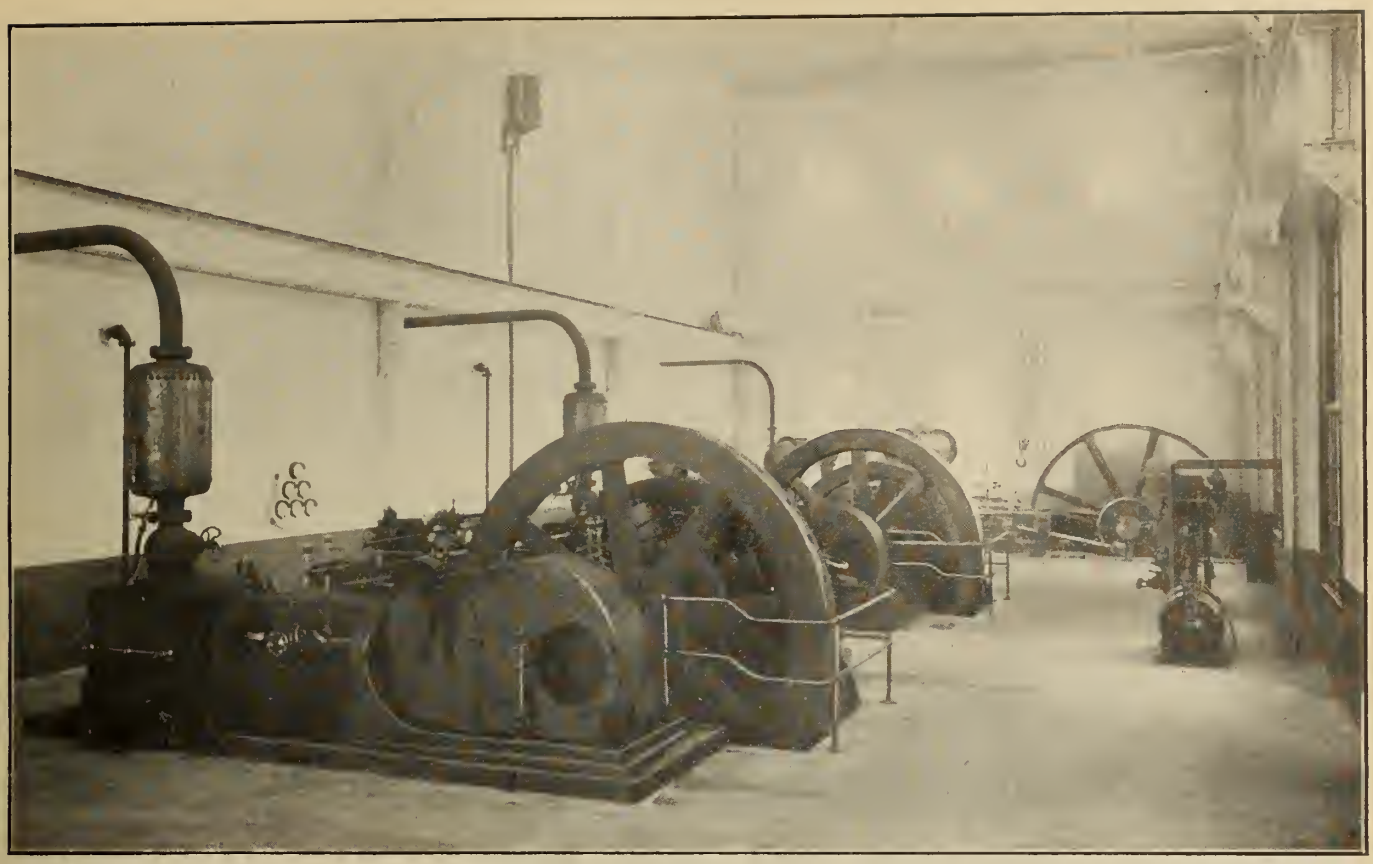
WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B. C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

WE MAKE Wheelock Engines, Corliss Engines, Ideal Engines, Gas Engines and Producers, Piston Valve Saw Mill Engines, Boilers, Heaters, Tanks, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION



Engine Room, G.T.R. Shops, Stratford, showing Goldie & McCulloch Engines and Rand Air Compressor.

# Central Power House Equipment, G.T.R. Shops, Stratford

## Vertical Water Tube Boilers, Stokers, Coal Handling Plant, Engines, Generator, Pumps, Piping, Heating System, Etc.

The Grand Trunk Railway has recently completed large new shops at Stratford. Electricity is used as a motive power and the large machine tools are driven by individual electric motors. The other machines are arranged for group drive. All the machine tools are arranged so that there will be a minimum of handling when work passes through the shop.

The power house is a self-supported steel structure, reinforced with concrete walls, 80 feet by 108 feet. All walls and foundations below the ground line have been water-proofed.

Four Wickes vertical boilers have been installed, each being 350 h.p., a total of 1,400 h.p. Foundations have been built for two more boilers which will bring the capacity up to 2,100 h.p. Green traveling chain grates and stokers are used, operated by small vertical engine.

The coal is dumped from the cars, and passing through a crusher, is conveyed to a steel receiver holding 250 tons of coal. Bucket conveyors carry the coal to the receiver from which it is conveyed by gravity to the different hoppers of the stokers. The same buckets remove the ashes and dump them into cars.

A Weber chimney 175 feet above the ground, or 187 feet, total height, furnishes draft to the four boilers, and is of sufficient capacity to take care of the additional two. The flue is 7 feet 6 inches.

The boilers work at 160 lbs. pressure. The header is 14 ins. diameter. From the header to the Goldie & McCulloch engines is a 7 in. steam pipe, 7 in. to Robb-Armstrong, 4 in. to each Waterous, McEwen and 5 in. to the Rand air compressor. All steam piping has been carefully covered by a good insulating covering.

### The Engine Room.

The main units in the new engine room are two large Corliss Goldie & McCulloch compound engines, 19 and 34 x30 in. These are fitted with sight feed oilers on the cylinders, and have independent steam gauges. The bearings are oiled by a gravity system. All the oil is returned to a Burt filter and pumped to an overhead tank where it is again ready for use. The low pressure cylinders are fitted with outside tail rests or shoes to keep the piston in alignment and from wearing the bottom of the cylinder.

These engines are each connected to a 400 k.w. Western Electric generator. The engines run at 150 r.p.m., and current generated is 220 volts d.c., direct current being used throughout the works.

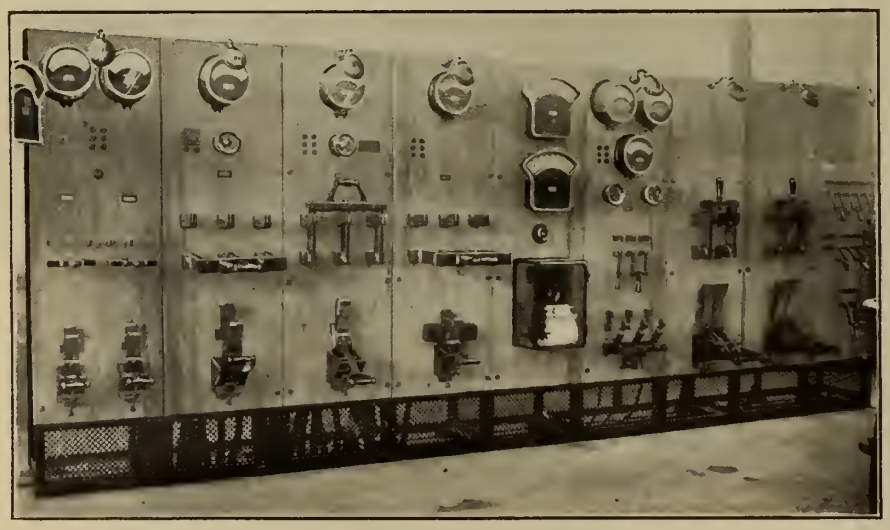
In the foreground, but not shown in the illustrations, is being installed a Robb-Armstrong 18 and 28x24-in. This engine was in the old power plant and will be direct connected to a Westinghouse 300 k.w. generator.

In the rear of the power house is a Rand air compressor and between it and the Goldie & McCulloch engines are being installed two Waterous-McEwen engines, which were in the old power plant. These engines are direct connected to 35 k.w. Canadian General Electric generators.

The Canadian Rand air compressor is steam-driven and an interesting feature

of its construction is that the air cylinders are in the centre. The fly-wheel has been arranged for rope drive so that at any time the Corliss steam cylinders may be disconnected and motor drive installed. This machine will compress 2,200 feet per minute and has water-cooled air cylinders.

Two gauge boards on the wall are for the air compressor and general purposes. The steam gauge board has a clock, gauges showing main and exhaust, air pressure, vacuum and water pressure. The other gauge board shows the vacuum, high and low steam and high and low air. An Allis-Chalmers-Bullock motor balancing set of 20 k.w. has been installed, which reduces the voltage from 220 to 110, the voltage required by the Cooper-Hewitt system of lighting. With this exception, 220 volts is used throughout the shops.



Switchboard in G.T.R., Stratford, Engine Room.

The switchboard is Western Electric, and contains all the necessary equipment for the completed plant. It consists of nine panels of blue Vermont marble. There are four generator panels, one full load panel with Westinghouse graphic recorder wattmeter and ammeter. Provision has been made, for taking the reading of any switch on the board. The equipment of this panel includes a differential voltmeter for the Allis-Chalmers-Bullock motor generator set. One panel is the equalizer, two power panels and one lighting panel. The instruments on the panels are Weston, with Canadian Westinghouse switches.

A ten-ton Smart-Turner traveling crane forms part of the equipment of the engine room.

### Pump Room.

Two boiler feeding systems have been installed. A pump is used and each boiler is fitted with an inspirator, which is used as an auxiliary. Two boiler feed pumps have been installed, but either one is of sufficient capacity to supply the boilers.

A 100,000-gallon pump supplies the shops with water. This water is drawn from a tank situated in the yard. Water is pumped to the tank from the Little Lakes, 2½ miles east of Stratford, by a plant owned by the G.T.R. situated at the lakes. Water may be drawn from the city in case of emergency.

Two vacuum pumps take care of the heating system, either being able to do the work. The returns are pumped into a Cochrane heater and from there to the boiler. The boiler feed pump operates automatically. The pumps will be equipped with revolution counters so that the work of each pump will be registered. The piping is of Crane design, the whole pump house equipment being supplied by the Canada Foundry.

### Piping System.

Piping from the power house to the shop is carried through an underground tunnel. The air pipes and power cables are also carried through this tunnel.

A separate system of piping is installed for drinking water, which is obtained from artesian wells, drilled on the shop site.

Water service lines loop all the buildings and provide fire protection, there being three yard and 30 shop hydrants located at points to cover every part of the works.

The entire building is heated by indirect radiation, utilizing exhaust steam from the power house in heaters. It may be necessary at times to assist the supply of exhaust steam by turning the live steam into the heaters, through a reducing valve. Three Sturtevant fans are operated by small horizontal engines the exhaust steam from which passes into the heating coils as an additional assistance to that supplied from power house. The experience up to the present time is that this system will provide ample heating requirements for the cold weather. The circulation of air throughout the shop is very good, keeping at the same temperature for the most part.

The air is taken in from outside by means of fans driven by small horizontal engines, exhaust steam of which also passes into heat coils. Fans, heaters, and engines are located on the balcony of the machine shop, the hot air being distributed through a system of underground reinforced concrete ducts with openings in walls and in ends of locomotive pits on the south side of the building. A small heating duct is also provided under the balcony and underground on the north side of the building, having vertical outlets through the floor.

Fig. 1 is a view of the power house, showing engines, air compressor and other equipment. Fig. 2 is a view of the switchboard, showing the equipment of it, to control the lighting and electric power for the various shops.

---

## LEAKY MAN-HOLES ON BOILERS.

By John M. Sewell.

Oftentimes after putting a man-hole plate on a boiler and starting the steam up, it is found that water is sizzling or steam hissing from the joints. A good method to pursue in putting the cover on to overcome this trouble, is to clean off all the old gasket and other matter which generally forms there. Take a mixture of graphite and oil, mixed to the consistency of a thick paste, and cover the side of a new gasket which will come in contact with the boiler head. Being sure the man-hole cover is in straight, tighten it up. Then, when the boiler is put under pressure, tighten it again; for in most cases a new gasket will soften and adapt itself to the unevenness of the joint. After this has been done once and the cover has to be removed again, a new gasket is generally not necessary, but the coating of graphite and oil ought to be again given to the gasket.

Generally the same gasket can be used four or five times, and I have known when one gasket has been used seven times by using this preparation. I have seen this method used for quite a long time now, and find that not in one instance has it failed to give good service.

---

D. J. Lewis, one of the consulting engineers of the American Radiator Co., was in Montreal recently on business. Mr. Lewis is manager of the Bundy department in New York.

## OIL AS A MARINE FUEL.

By G. P. Blackiston.

The use of oil as a fuel for ships is rapidly increasing in popularity. This is due, to a great degree, to its noticeable economy, not only in the actual cost of the fuel itself, but in labor for handling and storage space. From three to three and one-half barrels of oil do the work of one ton of best quality coal, and from this can be quickly figured the saving in favor of oil.

Fig.1.—S. S. Galveston Equipped with Oil System.

As three and one-half barrels of oil weigh about 1,000 pounds, it can readily be seen that oil fuel for a trip weighs only half as much as would coal. The water ballast bottoms may be used for storing the oil (sea water being pumped into each compartment where the oil has been taken out) so that the space ordinarily required for coal may be used for cargo, increasing the carrying capacity of the ship.

As the oil is fed mechanically by pumps to the boiler, there is a great saving in labor. Due to the fact that the oil can be loaded in about one-third the time required for the coal, more trips can be made. The fire can be changed quickly from a low to a most intense heat.

The fire is steady and regular, the steam pressure being always constant. The temperature of the stoke hole is lower, owing to the fact that the furnace doors are never opened and hot cinders and ashes are absent. A very interesting comparison of the advantages between oil and coal can readily be seen by the following data taken from the log of s.s. Venus plying between New Orleans and Simon, Costa Rica, C.A.

Coal used, 24 hours, 30 tons.

Oil used, 24 hours, 96 barrels.

Distance traveled in round trip, 2,600 miles.

Knots per hour with coal, 9.

Knots per hour with oil, 11¾.

Oil pressure at burners, 33 lbs.

Total oil used on trip, 1,000 barrels.

Indicated horse power, 950.

Looking closer into the subject we find that crude petroleum or fuel oil is a mixture of a number of hydro-carbons, all having the same component parts and their differences being entirely due to the varying proportions of these constituents.

1. The oil used must be of sufficiently high fire test. In fact, oil with a fire test of say 180 deg. or 200 deg. Fahrenheit is a safe fuel. Oil with a fire test of 250 deg. or 300 deg. Fahrenheit may be stirred with a red hot poker without being ignited, or a shovelful of hot coals thrown into it will sink and be extinguished.

2. The oil must be supplied to the burners under a sufficient and uniform pressure; this is best accomplished by means of small pumps and pressure chambers.

3. The oil should be pre-heated to facilitate atomization.

4. The burner should feed the oil in a finely atomized condition; a properly constructed burner will show no dark stream of oil entering the furnace from its tip, instead the oil will emerge from it in an almost imperceptible spray or vapor.

5. The steam should be super-heated before going to the burner.

6. Just the right proportion of air should be admitted to the fire box or combustion chamber to completely burn the fuel. Both experience and scientific experiment have laid it down as a general rule, that an excess over the proper amount of air, is not only useless, but actually exercises a cooling effect on the combustion chamber.

7. The combination heater and pressure chamber should be fitted with a proper arrangement of relief valves to permit an excess of oil to return to the tanks.

The U. S. Government several years ago became very much interested in this fuel and installed a Tate, Jones & Co., Pittsburg, oil fuel system in the hydraulic dredge, General C. B. Comstock, built for Gulf of Mexico service. The same style equipment was later installed in the U. S. army hydraulic dredge Galveston.

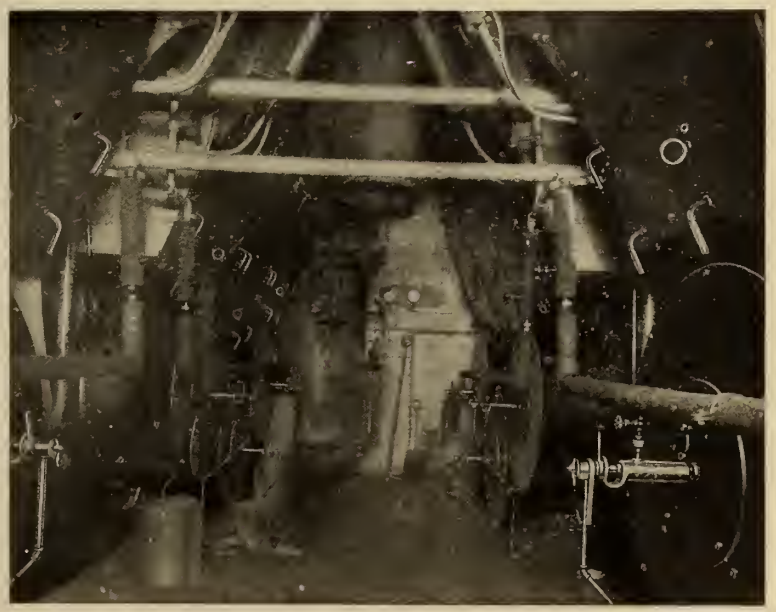
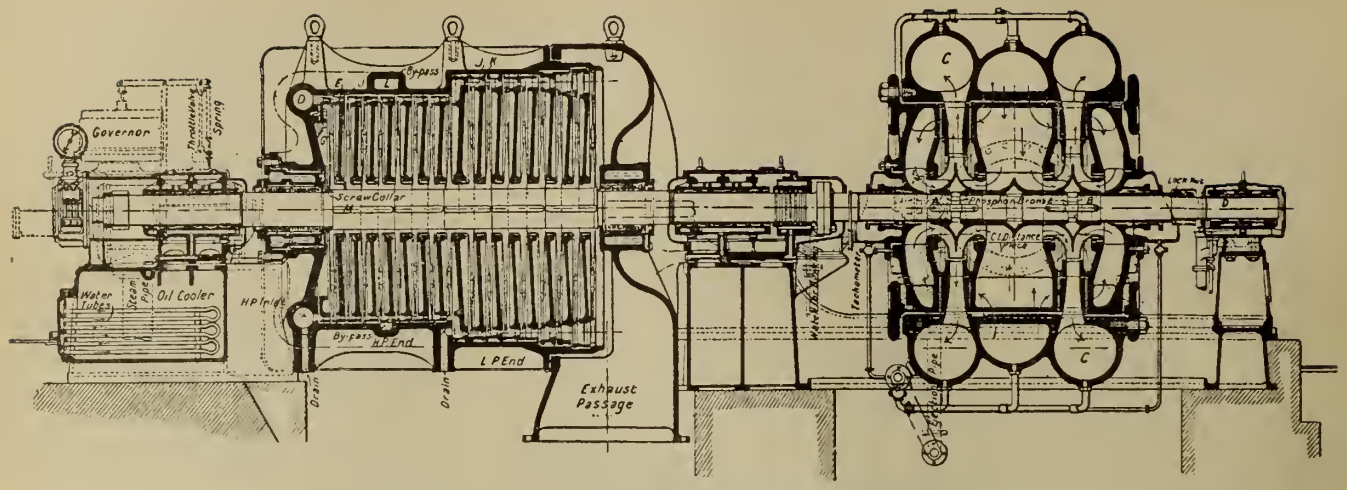


Fig. 2.—Boiler Room Showing Oil Furnaces.




Longitudinal Section Through Mather Turbine and Pump.

# A Modern High Speed Turbine Pump Instalation

## The New High Pressure Pumps at the St. Gabriel Pumping Station of the Montreal Water and Power Co.—A Description of the Two Main Units and Auxiliaries.

The last few years have seen rapid developments in all classes of power apparatus and the steam turbine and turbine pump have not been left behind. Just here might be mentioned the difference between a "turbine pump" and the older design of "centrifugal pump." A turbine pump is a development of the centrifugal, the difference lying in the internal construction. In the latter the water leaves the impellers, going directly into the volute chamber, whereas in the turbine pump the water is guided from the impellers into the volute chamber by means of specially designed guide vanes which gives the water an easy path.

One of the main features of steam turbine instalation is the economy of space and the same may be said of turbine pumps. These pumps are capable of working against very high heads, and, owing to the unavoidable slip of the water in the rotors, there is less liability to stack.

A fine Canadian example of electrically and steam turbine driven turbine pump instalations is the one just completed at the St. Gabriel Pumping Station of the Montreal Water & Power Co., in Charlevaix Street, Montreal. Here, side by side, are two turbine pumps, one driven by an electric motor and the other by a steam turbine. Each has a capacity of 15,000,000 imp. gals. per 24 hours, against a head of 175 pounds. The pumps, motor, steam turbine and all auxiliaries, except where mentioned, were built by Mather & Platt, Ltd., Manchester, England, and were installed by the Drummond, McCall Co., Montreal, under the direction of T. Y. Sherwell, their supervising engineer.

### The Electrical Unit.

This pump was installed in July, 1908, and put in operation on September 7th. It is direct-connected to a 3-phase induction motor of 1680 B.H.P. The current is 375 amperes at 2200 volts, with 63 frequency. The speed of the unit is 469 revs. per min. Connection to the pump shaft is made through a flexible coupling, the torque being transmitted by means of a belt interlaced between projections on the two flanges. The arrangement is clearly shown in the illustration. Electric power being supplied for only 20 out of the 24 hours, made an auxiliary unit necessary, so the steam turbine unit, of which this article is a description, was ordered and installed.

### The Steam Unit.

This unit has just been erected and consists of a 1760 B.H.P. Mather-Zoelly impulse turbine direct-connected to a Mather & Platt turbine pump. Although this pump is the same capacity as the electrically driven one, it is much smaller and lighter. This is made possible by the high speed at which it runs, namely, 1500 revs. per min. Steam is supplied through a 10-inch underground main steam pipe. This enters a sheet iron separator 24 in. diameter and 4 ft. long, which is just inside the wall of the power house. From this a 7 in. pipe leads to the turbine and a 5 in. pipe to the auxiliary engine. The steam pressure at the boilers is 175 lbs. per sq. in, and 165 lbs. at the engines. The steam is superheated 150 deg. F. by means of B. & W. superheaters in the boilers.

From the turbine the steam is exhausted through a 34 in. pipe to the surface condenser D, Fig. 5, which is directly underneath the turbine. This contains 3420 sq. ft. of cooling surface. The circulating water is by-passed, through pipe F, shown in photograph of pit, from the auxiliary or primary low lift pump, spoken of later.

The air pump is a three throw machine of the well-known Edwards type, furnishing 27 ins. vacuum. The peculiar feature of this pump is the fact that there are no suction valves in connection with it. The water is elevated, by displacement, onto the top of the plunger and on the up stroke is forced out through the discharge valves. A glance at the accompanying cut will make this clear. The exhaust from the condenser is 8 in. and the discharge of air pump to the hot well is 4 in. There are two atmospheric exhaust valves, made by Templer & Ranoe, Ltd., England. One of these, shown at E, Fig. 5, is on the exhaust from the auxiliary engine, and one on the exhaust from steam turbine.

### Auxiliary Engine and Pump.

The auxiliary and circulating pumps are both driven by the same engine, which is shown at B. This is a Belliss & Morcom high-speed engine of the vertical closed type. It develops 245 h.p. at 425 revs. per min. The auxiliary pump is direct connected, but the air pump is driven by gears having a ratio of 4 to 1. The engine is compound and

steam enters through a 5 in. pipe. The auxiliary pump is a low-lift turbine pump and delivers water to the main turbine pump under 21 lbs. pressure. This is to obviate any shock to the water upon entering the suction of the turbine pump. The circulating water is also supplied by this pump as previously noted. The water is brought into the main well from the river St. Lawrence and thence to the auxiliary pump.

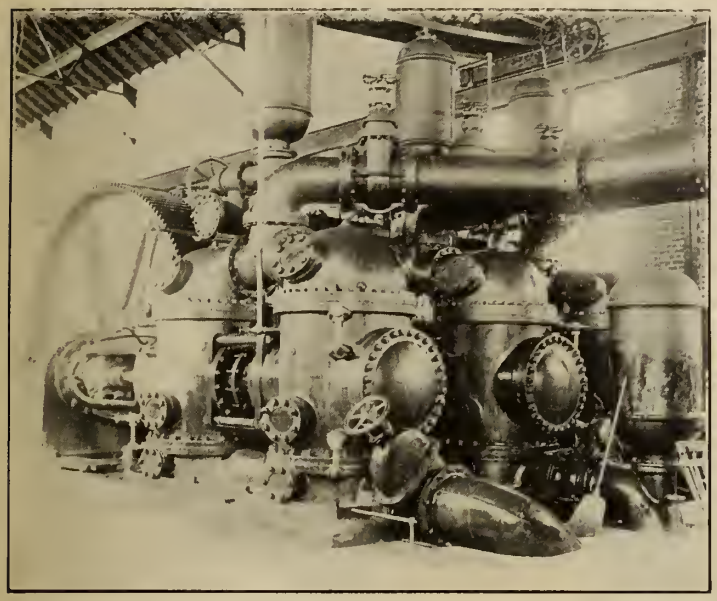


Fig. 1.—One of the Six Million Gallon Electrically Driven Reciprocating Pumps.

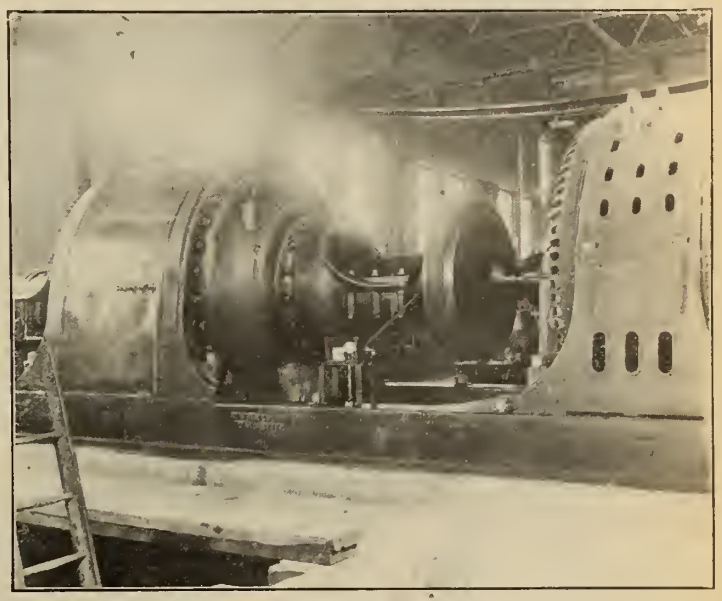


Fig. 2.—View of Fifteen Million Gallon Electrical Unit.

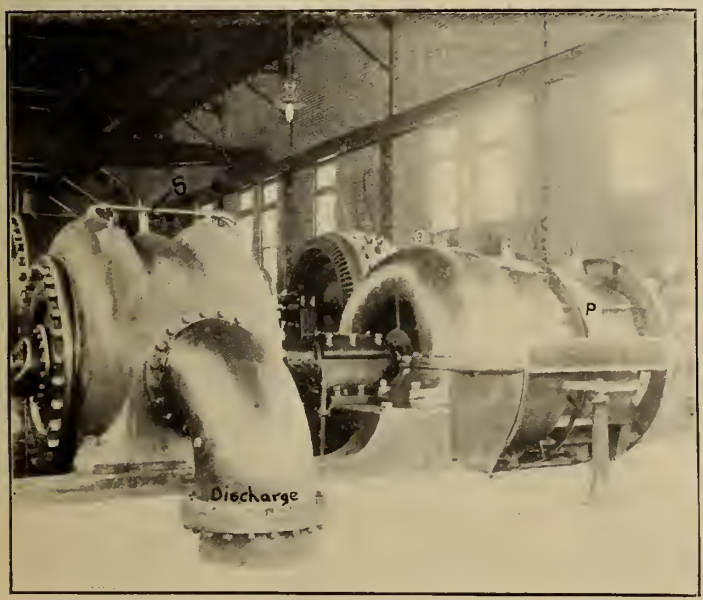



Fig. 3.—Fifteen Million Gallon Steam Turbine Unit.

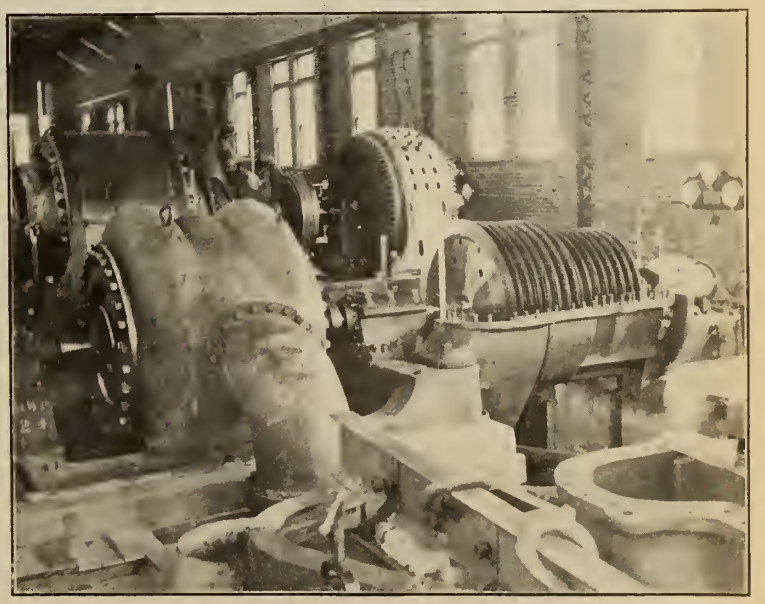


Fig. 4.—Steam Turbine During Erection. Top of Casing Removed.

### The Steam Turbine.

The longitudinal section in Fig. 6 is not that of the turbine shown in the photographs, but will serve to show the arrangement of the wheels in their separate chambers. Each wheel runs in a compartment by itself, and the number of wheels is determined by the range of expansion. In no case is the pressure in a compartment less than 58 per cent. of that in the previous one.

The advantage derived from this limitation of pressure is that the nozzles may be of the easily designed convergent type, instead of divergent nozzles, without interfering with the full expansion of the steam.

Steam enters an annular steam chest through a governor controlled throttle valve. It passes to the first wheel chamber through nozzles which are cored in the apartment casing, does its work on the wheel and then enters the next wheel through nozzles in the wall between the apartments and so on to the exhaust chamber at the other end of the casing. The nozzles at the high pressure end are in two groups diametrically opposite, and their depth is kept constant through as many wheels as possible, the extra steam space being obtained by the addition of more nozzles in the casings, as the steam pressure becomes less. The depth is increased only when it is impossible to create more nozzles of the original depth in the circumference. The wheels at the low pressure end are also increased in diameter so as to get the requisite steam way without the use of too long blades. Provision is made by means of a by-pass valve for admission of high

pressure steam to additional wheels when over loads are encountered. This is the same as admitting high pressure steam to the intermediate or low pressure cylinders of a reciprocating engine. The by-pass chamber is shown in the longitudinal section and also in the photograph.

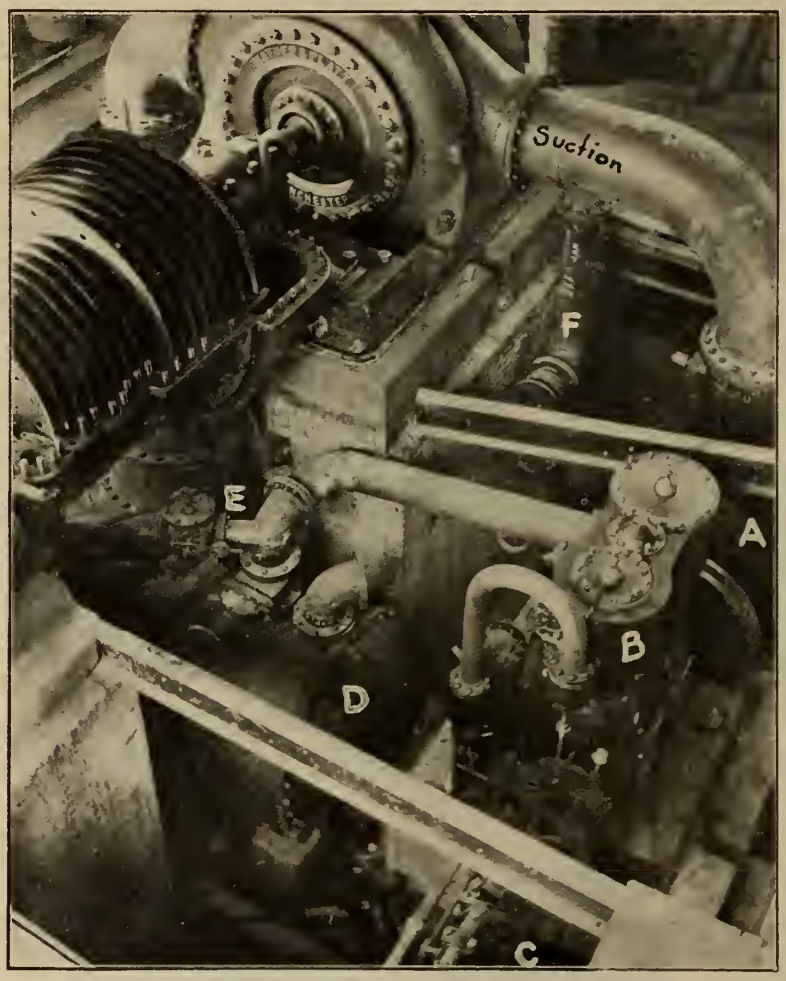



Fig. 5.—Looking Down on Condenser Pit During Erection.

The stop valve is of single beat construction acting horizontally. It is controlled by a handwheel and bevel pinion engaging a bevel wheel on the spindle. To prevent the valve coming into contact with its seat with a blow, the thrust of the spindle is transmitted through a spring, which, after closing the valve, is compressed until the end of the spindle is brought into play making the closure rigid. In connection with the stop valve is an emergency trip arrangement which may be used when it is desired to close the valve very quickly.

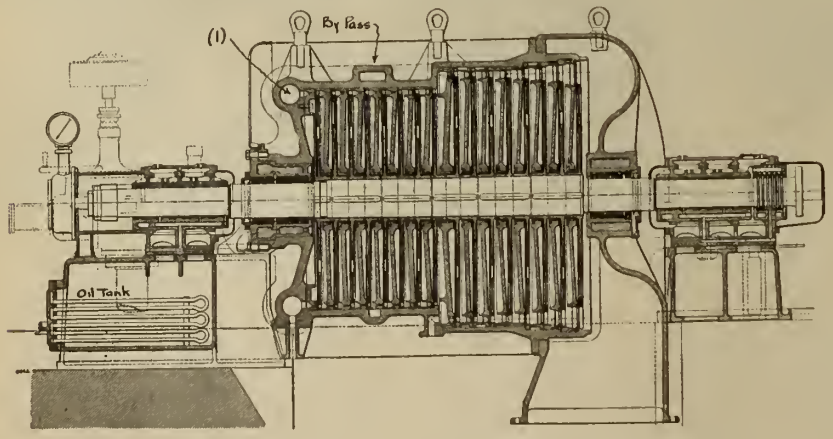



Fig. 6.—Logitudinal Section of Steam Turbine Engine.

The throttle valve is directly controlled by the governor without the intervention of relays. The governor used by Mather and Platt is of the type known as the "Chorlton Whitehead." This governor will maintain a constant speed at all loads, being prevented from hunting by an ingenious arrangement of springs and a dashpot, which work entirely within the casing of the governor and run wholly immersed in oil.

The cover and diaphragms are divided horizontally and when the wheels are to be removed or examined, the whole of the upper part can be lifted off at once by means of eye bolts provided for that reason. The diaphragms or apartment walls are made of cast iron and are slightly dished. These are located longitudinally by circumferential flanges which form distance pieces between each successive diaphragm.

The central hole in the diaphragms is bushed with bronze, the bore of the bushing being turned with numerous grooves minimize the steam leakage from one compartment to the next. The nozzles are divided by curved iron plates which form their sides, the top and bottom of the nozzle passages be-

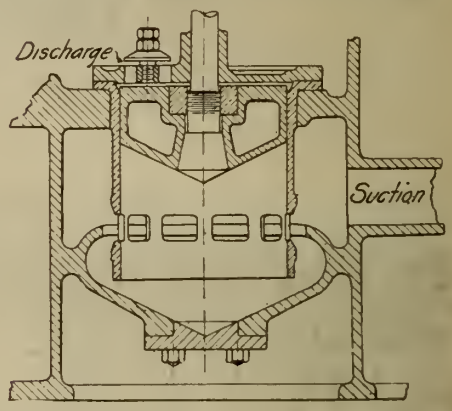



Fig. 7.—Sectional View of Air Pump.

ing the main casting itself, into which the division plates are cast.

The bearings are fixed on the bedplate quite independently of the casing, receiving no heat therefrom. They are water cooled and furnished with forced lubrication. They are lined with white metal and do not swivel. The bearing at the low pressure end contains a thrust block. This is used only to locate the rotating parts, as would collars, there being practically no end thrust in the unit in either direction. In adjusting the turbine rotor the bearings are set into the required position to give the necessary blade clearance, and, when the right position is determined, are secured by four steady pins, fixing the position once for all.

The oil, after leaving the bearings, is returned to a cast iron tank beneath the bearing on the high pressure side, where it is cooled by means of water pipes inside the tank.

The wheels, which are forged in one

piece with the boss, are keyed to the shaft. They are polished all over to minimize disk friction. About half-way between the boss and the rim the wheel is thickened and through this thickened part a few large holes are drilled. The function of these holes is to permit of the instantaneous equalization of pressure on each side of a wheel when the load is thrown suddenly on or off. Any end thrust there may be taken up by the thrust block in the low pressure bearing.

The blades of nickle steel are much fewer per wheel than in the reaction type. These are secured to the periphery of the wheel by a special patent device and are separated by accurately cut distance pieces, the whole being backed by a grooved ring of forged steel riveted to the wheel. The blades are made of sheet metal, bent to the required curvature and notched at the root as shown. They are ground to a good finish, both inside and out, and the back of the leading edge is ground to a very fine edge. The angle of exit of each blade is smaller than the entrance angle and to avoid steam choking, the distance pieces are so shaped as to increase the radial depth of the blade at the exit edge to compensate for the difference in the angle. After assembling, the whole wheel is accurately balanced.

### The Main Turbine Pump.

The main turbine pump has two impellers running in parallel. These are of a closed type and have a double suction thereby causing an absolute balance in the pump. The impellers discharge the water onto specially designed guide vanes, giving it an easy path free from shock. From the guide vanes the water passes into an annular chamber and from there is discharged directly to the mains. The discharge is controlled by butterfly valves, which offer the advantage of being perfectly balanced under heavy pressure, and, therefore, easily operated by one man. The discharge pipe is 24 in. in diameter and opens out to 30 in. in the mains.

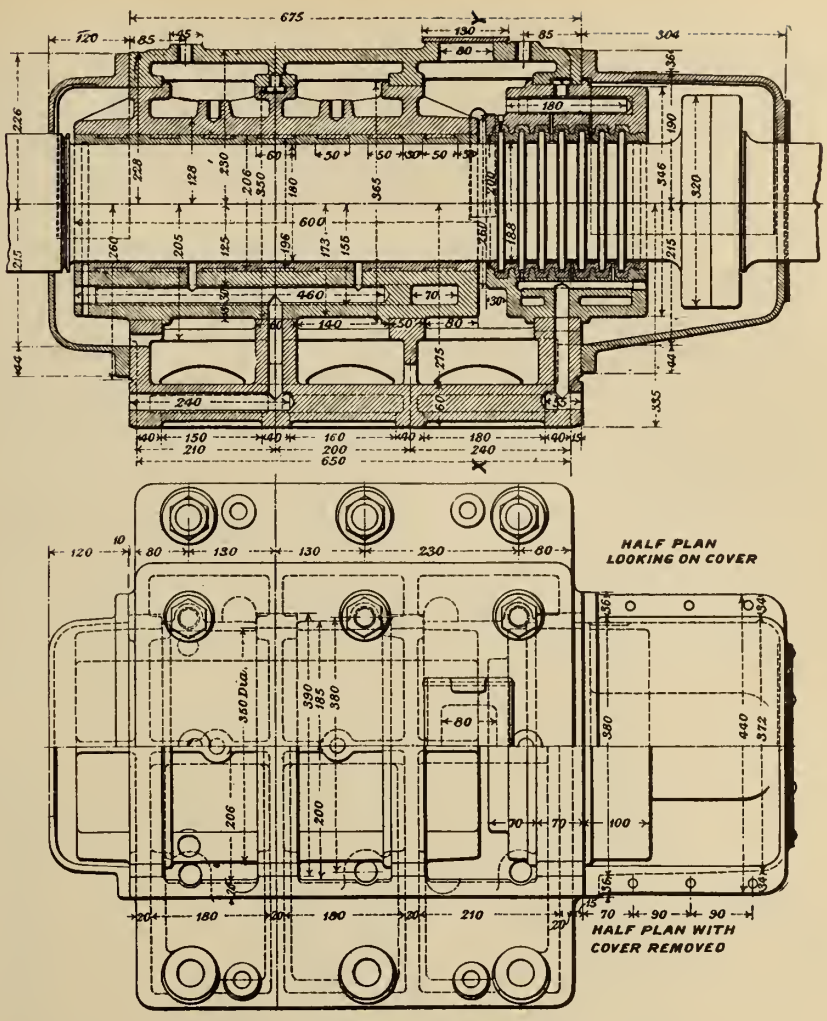



Fig. 9.—Bearings at Low Pressure End.

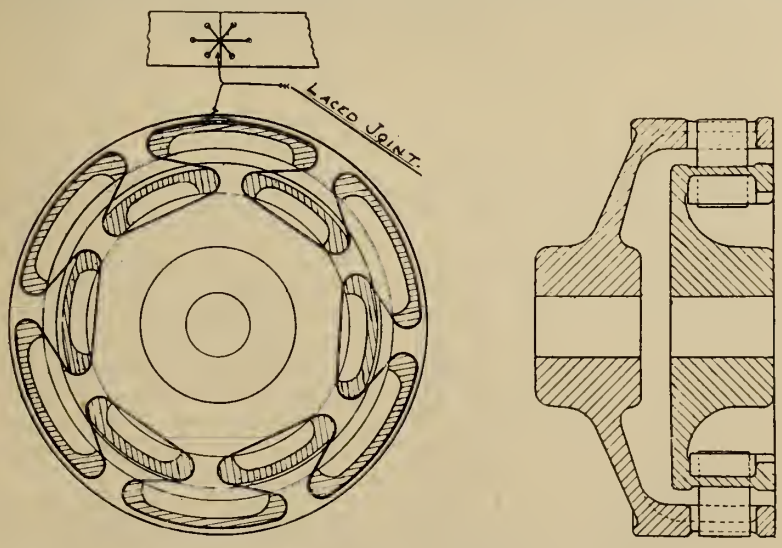



Fig. 8.—Flexible Coupling on Electrieal Unit.

To prevent the ingress of air to the pump, the packings on the shaft at either end are waterlogged. This is accomplished by carrying water from the auxiliary pump to a cast iron lantern gland-ring put in the stuffing box before placing in the hemp packing. The pump is primed by a steam ejector, the pipes of which can be easily seen in the photo, on top of the pump at S.

Taking the steam turbine and pump together, the rotating parts are hung on three bearings only. Two of these are the turbine bearings proper and the third the outside bearing of the pump.

The steam end of the turbine is perfectly free to move to allow for expansion. This is necessary on account of the large difference in the temperatures of each end. At the steam end, the temperature of the steam at 165 gauge pressure is 374 deg. F plus the amount of superheat (150 deg.) or 524 deg. F. At the exhaust end the temperature of the steam is that corresponding to 27 in. vacuum, or 116 deg. F., thus the difference between the two is 408 deg. The bearings being absolutely apart from the casing and the steam pipe having a complete loop in it between the separator and stop valve, there is nothing to prevent the expansion movement of the casing.

The three original electrically driven reciprocating pumps, with a combined capacity of 13,000,000 imp. gals. per 24 hours, occupy approximately 126 ft. by 40 ft. of space, whereas the two centrifugal pump units with a combined capacity of 30,000,000 imp. gals. take up approximately 36 ft. by 40 ft.

The weight of the steam turbine unit and all accessories, including the piping within the building, is 120 tons, while the weight of the electrical unit is 108. The time consumed in coming to full load from "all cold" is about fifteen minutes.

## REVELSTOKE GAS PRODUCER PLANT.

By R. B. B., Vancouver.

Quite a number of gas producers have been established in the West during the past few months, and some of the larger users of power find that their expense account is reduced by adopting this method. Gas producers are now to be found in Vancouver and New Westminster, while in Kamloops and Revelstoke they have been installed by the municipalities. In Kamloops there was a little trouble at first, since coal mined at Bankhead was used, and a special grate had to be manufactured. In the plants referred to, the producer installed was the type manufactured by the Canada Foundry Company, and the satisfaction that has resulted shows their usefulness.

In this producer steam and air are passed through red hot coal. The resultant gas being washed and cooled, is then suitable for the engine. The suction type, which is the latest installed at Revelstoke, has the engine piston drawing a charge of gas automatically from the producer as it goes forward. The plant remains under less than atmospheric pressure, consequently there is no fear of any explosion. The producer itself is built of riveted steel plates, no cast iron being used, and the chance of cracking due to sudden changes in the temperature caused by the atmosphere or by the injection of cold water on hot metal is thereby eliminated.

To raise steam in the plant, different makers use two principles. (1) A system of internal vaporization, where the cast iron boiler type, situated inside the producer, is used; (2) an external system where hot gases from the producer gives up heat to some system of boilers which differ in style in various makes. The latter is the style used by the Canada Foundry Company.

Certain advantages are claimed for the second principle. In the first place, the external vaporizer can be cleaned while the plant is in full operation and without disturbing the main points of the producer; second, this system avoids troubles when hard water is used, and, third, it utilizes waste heat in gases for raising steam, instead of extracting heat from the fire itself, which would not be economical.

Besides the external vaporizer, the system in point has a patent method for raising steam by injecting water through a coil on a steel plate below the fire cage, which is heated by heat taken from the ashes and radiation from the fire bars. This source of heat is always ready, thus avoiding delay until outgoing gases give up heat to the external vaporizer. It is possible to raise steam necessary for the complete plant by coil only while the external vaporizer is being cleaned, or otherwise out of use, without interfering with the continuous operation of the plant. This external vaporizer, which is a patented device, is simple and ingenious in pattern, consisting of a gauge covering the cast iron pipe, the gauge acting as a distributor of water over the pipe's surface, thus jacketing the pipe itself, which carries away the hot gases to the engine with a thin film of water which is quickly turned into dry steam. Anthracite coal, coke or charcoal can be used, a small quantity being supplied every two hours. The seavenger device on the engine prevents all pre-ignition, while the scrubbers in the producer ensure pure and clean gas. The engine can be started in fifteen minutes at ordinary times, and when the fire is banked over night, in six minutes.

## PUTTING GASKET ON PUMP.

By John M. Sewell.

One of the easiest and best ways to put a gasket on a single acting pump and get sure results is to use the following method:

Take the nuts off the bolts and uncouple the unions on both the steam and

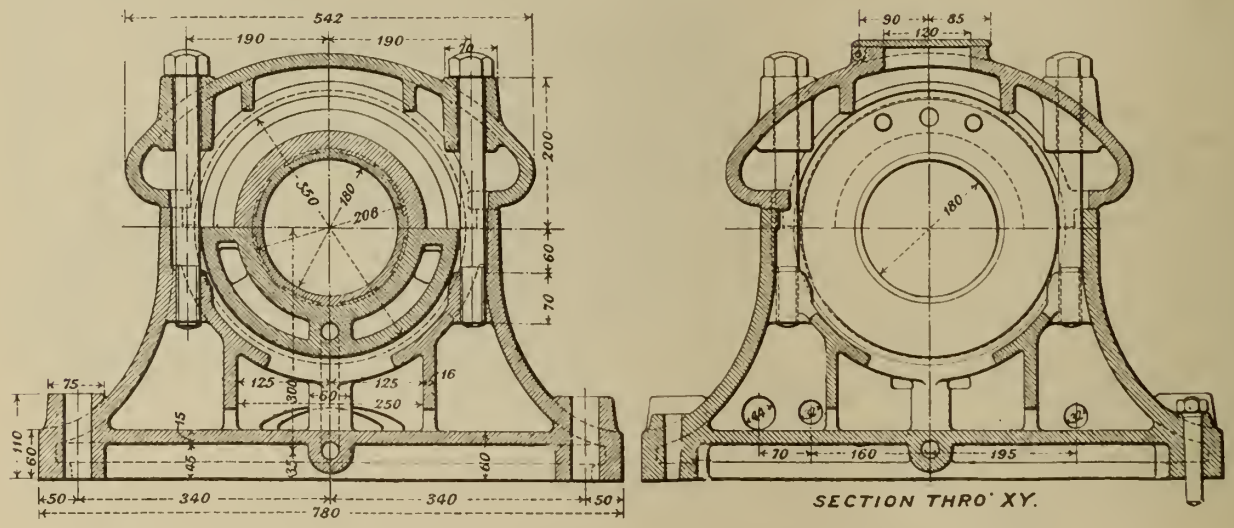



Fig. 10.—Sectional View Bearings at Low Pressure End.

exhaust pipes. The suction and discharge pipes generally will spring enough on small single acting pumps to give clearance between the foundation and foundation bolts.

Have the piston on the inward stroke of the pump, then loosen the joint to be packed and slide the cylinder backwards so that the piston will be left clear, then clean the flange of the old gasket and other matter which generally collects and place a new gasket on the joint in the proper position. Then push the cylinder back to its proper position and couple up, being sure to make all joints tight.

A good gasket to use for this kind of work is a thin sheet one about 1-16-inch thick, cut to the largest diameter that the inside of the studs will allow, or if preferred, cut to the size of joint and punch holes to take the studs, being sure to leave enough clearance around the studs to make a close fit, when the joints are brought together.

# The Distinctive Features of "Two-Cycle" Gas Engines*

Second Article of a Series on the Gas Engine, in which the Term "Two-Cycle" is Defined — Description of Action of Gas in the Cylinders.

The two-cycle engine is a modification of the Otto. Instead of the cycle of operations being completed in four stokers, as in the Otto, however, the cycle is completed in two, giving an impulse to every revolution. On account of this feature it has been termed the "two-cycle" engine.

This type is generally much simpler than the four-cycle and develops more power in proportion to the size, which is evident since an impulse is imparted to the piston every revolution, instead of every second revolution, as in the Otto cycle. A very uniform speed of rotation is also obtained, making a heavy fly-wheel unnecessary.

The two-cycle gas engine has an enclosed crank case in which the charge is partially compressed before entering the cylinder. As the piston moves towards the head of the cylinder, it creates a partial vacuum in the crank chamber and draws in the explosive mixture. This charge is compressed to about ten pounds in the crank case. An automatic valve prevents the charge in the crank chamber from escaping. It closes as soon as this gas is compressed sufficient to raise it above the pressure of the atmosphere. On some types of two-cycle engines this is the only valve, thus making an exceedingly simple gas engine.

When the piston reaches its lowest position the exhaust and admission ports are uncovered, allowing the compressed charge to enter the cylinder. In some types the charge is admitted as shown in Figs. 1, 2, 3 and 4, while in others the charge is admitted through a port in the side of the piston, which comes opposite the port in the cylinder wall.

On the upward stroke, the piston shuts off both exhaust and admission and compresses the charge into the clearance space. The charge is then exploded and the piston makes its working stroke. As the piston goes forward the admission and exhaust valves are opened and the new charge sweeps out the burnt gases. That there may be no waste of gas the cylinders are shaped like that shown in Fig. 5, or are cast with a baffle plate. The return of the piston covers the exhaust in time to prevent the escape of the charge. The operations above the piston and in the crank chamber are simultaneous. When the charge is ignited in the cylinder and the piston goes forward, the gas in the crank chamber is compressed. When the piston is returning, the automatic valve admits gas to the crank chamber.

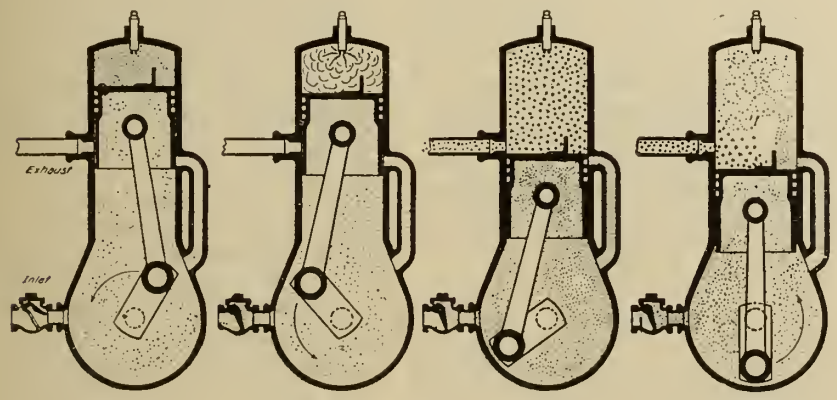



Fig. 1. Fig. 2. Fig. 3. Fig. 4.

The danger in this type is back-firing on account of exhaust and admission having such a short interval of time between them. If when the exhaust opens, the charge is still burning, the entering charge is ignited, causing the piston to reverse its motion. Sometimes the explosion travels back to the crank case. The crank case should be designed to take care of the added pressure caused by back-firing.

There is the possibility, too, in this type of gas engine of having a large amount of waste. On account of the two ports, admission and exhaust being open together, some of inrushing charge may be lost. On the other hand if the exhaust is made to close early to eliminate this loss there will be a large amount of burnt gases which will lessen the power and lower the efficiency of the engine.

Referring to the first diagram, Fig. 1, shows the position of the engine when the mixture in the cylinder is in compression. The automatic valve at the inlet is also shown. Fig. 2 is ignition, made by spark or other ignition. The expansion continues until the exhaust port is open as shown in Fig. 3.

The piston finishing the downward stroke admits the charge as shown in Fig. 4. The baffle on the top of the piston prevents the charge from rushing out through the exhaust. The shape of the piston, Fig. 5, on the addition of a baffle plate, deflect and force the gases to the upper part of the cylinder.

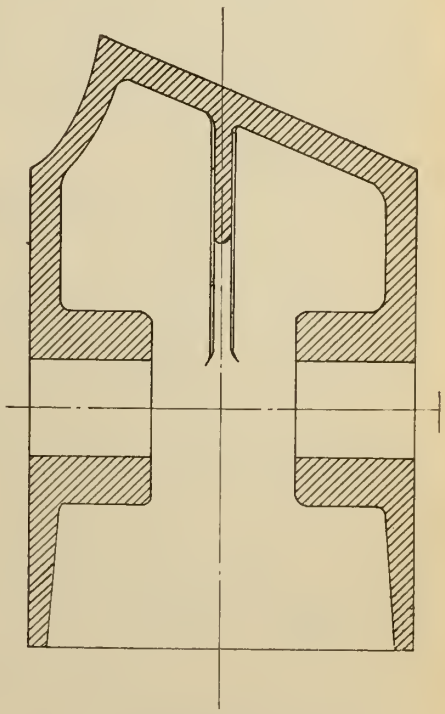


Fig. 5.—Piston of 2-Cycle Engine.

In the April issue will be the third article of the series describing several prominent makes of engines now in use in Canada.

---

Harry D. Warren, president and treasurer of the Gutta Percha & Rubber Mfg. Co., died at the family residence, Red Gables, Wellesley Street, Toronto, on March 5.

*The first article of the series appeared in the February issue, "The Distinctive Features of Four-cycle Gas Engines.

# Course of Lessons for the Instruction of Stationary Engineers

## Fourth of a Series of Interesting Educational Articles—This Article Takes Up in a Simple and Thorough Manner the Definition of Steam and Its Generation.

By W. A. CROCKETT

Steam is water vapor. It is a colorless, expansive, invisible fluid. It is water changed to a gaseous state by the application of heat. The subjects of heat and steam are very closely connected. We cannot have steam without heat, nor heat without motion and this is why it is of such inestimable value to mankind. Steam engines are practically heat engines, because the steam is the medium by which the heat is carried from the coal to the completed work at the engine cylinder. The vaporization takes place quietly and by evaporization from the surface, if the vapor pressure is below the external pressure. Thus at the temperature of melting ice (32 deg. F.) the vapor pressure is only .077 lbs. per square inch, but it increases with rise of temperature, till at 212 deg. F., it becomes equal to 14.7 lbs per square inch.

If the external pressure is that of the atmosphere, it will be approximately equal to this amount, and with the slightest excess of the vapor pressure over it, the change of the water into steam occurs rapidly and with ebullition. If the external pressure is greater than that of the atmosphere, as in a steam boiler, boiling does not occur till the water is at a much higher temperature. For example, in a boiler giving steam at 250 lbs. per square inch the temperature of the water is approximately 401 deg. F. instead of 212 deg. F. Steam under these conditions in the presence of water is called saturated steam, and is of a definite density for each pressure. This density is the greatest that steam can possess under the given pressure and also corresponds to a particular temperature, a fall of temperature producing a fall of pressure and condensation of some of the steam, while a rise of temperature produces the converse effect, the pressure increasing much more rapidly than the temperature. Observations of the relation between the two were very carefully made by Regnault and the results tabulated. They may be calculated from the equation given by Rankine :

$$\log p = A - \frac{B}{T} - \frac{C}{T_2}$$

where p. is the pressure and T the absolute temperature. For pounds per square inch and degrees F., A equals 6.1007 ; log B equals 3.43642 ; log C equals 5.59873.

If just enough heat is applied to change all the water into steam and up to the point where the last drop of water is evaporated the steam is saturated and at the pressure of 14.69 pounds per square inch, the temperature remains at 212 deg. F.

After the last drop of water is evaporated there is a change in the effect produced when heat is applied. Both the temperature and volume of the steam now increase and in many respects resemble those of a perfect gas. Steam heated away from water is said to be superheated and its specific heat under constant pressure is .48. The total amount of heat required to generate steam increases as the temperature at which it is required rises, yet owing to the falling off in the heat of vaporization the difference is small, and for use in steam engines is over balanced by the increased economy due to the higher working temperature. Steam naturally occupies a very much larger volume than the water it is obtained from. Thus 1 volume of water at ordinary temperature produces 1,700 volumes of steam at 212 F.

### Steam a Vapor.

The vapor is lighter than air at the same temperature, and, contrary to the common idea, is invisible, the white cloud seen issuing from a steam pipe, and usually called "steam" is in reality a fog of minute liquid particles produced by condensation. Steam is an expansive fluid and in this expansion is its great factor of usefulness to us. When saturated steam expands in a non-conducting cylinder, and during its expansion performs mechanical work its pressure falls on account of increase of volume and because of liquefaction.

We see that all steam has a sensible heat corresponding with the temperature of the water it is evaporated fromi If you boil water under a pressure of five atmospheres or 75 pounds pressure, the sensible heat is 306 degrees F., the boiling point at that pressure, but the latent heat has decreased by the same number of heat units that the boiling point increased, so the total is the same in all cases. We also find the following in evaporating a pound of water under atmospheric pressure, the temperature remains at 212 degrees F. but the volume was increased to 1644 times that of the water ; evaporating under 75 pounds pressure the temperature also remained the same 306 degrees F., but the volume is only 295 times that of the water it was evaporated from.

### Expansion of Steam.

The expansion of steam follows what is called Marriott's law of expanding gases, i.e., one half the pressure doubles the volume. So if steam is let into an engine cylinder at 80 pounds pressure and cut it off at one-fourth stroke, it is at 80 pounds up to the point of cut-off. At one-half stroke, because it has doubled its volume, it is reduced to one-half pressure or 40 lbs., while at three-fourths stroke the volume has trebled and the pressure has dropped to nearly 27 pounds, and this is why it is economical to run engines that use steam expansively.

Steam at 27 pounds pressure is very much cooler than steam at 80 pounds and this difference in its temperature has been converted into mechanical work by our steam (heat) engine.

Steam gives up its latent heat when condensed. This is why steam is a good medium to heat our buildings, and also a good reason why it requires so much cold water to condense the steam back to water quickly as in an engine movement. Steam has a very rapid movement. It will flow under a pressure of one and one-half atmospheres into the air at a velocity of 67,500 feet per minute and into a vacuum from a pressure of one atmosphere at the rate of 111540 ft. per minute, or 1,242 ft. per sec. This is why a steam pipe and the steam ports of a cylinder may have a very much smaller area than piston itself, and the rate of flow of steam in pipes is the basis of determining their sizes. The whole science of the intelligent use of steam is to save, utilize, and direct its heat. An 80 horse power automatic cut-off engine using 30 pounds steam per horse-power hour, and discharging into the atmosphere at a back pressure of one pound per square inch will discharge heat enough to supply 9,000 square feet of radiating surface,

or enough to heat a building containing 720,000 cubic feet of space.

### Generation of Steam.

Let the area of cross section of a vertical cylinder be equal to one square foot and let this cylinder contain one pound of pure water, of the temperature of 32 degrees F. supporting upon its surface a frictionless piston. If heat be applied to the bottom of this cylinder, a series of changes will occur which may be divided into the following stages :

Stage 1.—Suppose for the better understanding of the problem the pressure due to the atmosphere and weight of the piston equivalent to a total pressure of 85 pounds per square inch. If the heat added to the water produces a pressure just sufficient to balance the load on the piston it will be found that the water has been raised to a temperature T, as shown by the thermometer, of 316.02 degrees F. But this does not represent all the heat which has been added. During the changes that have occurred it is found that in the generation of steam of the assumed pressure 1.78 of a thermal unit has been expended which is not shown by the thermometer. Let H indicate this amount of heat. The whole amount of heat expended during the first stage of the operation reckoned from 32 degrees F. will then be : (t-32) plus h equals (316.02 deg.—32) plus 1.78 equals 285.8 B.T.U. This value (t-32) plus h, which in the present example is equal to 285.8 thermal units, is called the heat of the liquid, reckoned from 32 degrees F., or the quantity of heat required to raise the temperature of one pound of pure water from 32 to 316.02 F. against the pressure of 85 pounds per square inch.

Stage 2.—If more heat be added steam will be formed, the temperature and pressure remaining constant until all the water has been evaporated or converted into steam. When all the water has been converted into steam its volume will be increased by u cubic feet above that which it had at the end of the first stage. As the area of the piston is one square foot, the height which the piston has been raised will be u feet and as the load on the piston is 144 times 85 pounds or 12,240 pounds, mechanical work equal to 12,240 times u will have been performed during the second stage of the operation, and this amount divided by778, the heat equivalent of one foot pound of work, will in this case be 80.4 thermal units. The heat thus expended is called the heat equivalent of the External Work of Vaporization, and is usually designated by A times p times u, or 1-778 times the pressure in pounds per square foot above zero, times the increase in volume from the commencement of the evaporization of the water.

The heat we have just considered is not all that has been added during the second stage in fact it forms but a very small portion of the heat expended in the evaporation of the water. The total heat of vaporization usually designated by r, is in the above example, equal to 892.5 thermal units. The difference between that due to external work of vaporization and this amount or 892.5 less 80.4, that is, 812.1 thermal units is the heat equivalent of Internal Work of Vaporization, and is designated by the Greek letter p (rho). The total heat thus far expended indicated by the Greek letter $\lambda$ (lambda) may be summarized thus :

1st stage, q=(t—32)+h=(316.02°—32°)+1.78=285.8 B.T.U.

2nd stage, r=(p+A.P.U.)=(812.1+80.4)=892.5 B.T.U.

1st and 2nd stages.

$\gamma = (q+r) = 285.8+892.5 = 1178.3$. B T.U., or the total heat required to convert one pound of pure water of the temperature of 32° F into steam of the pressure of 85 pounds per square inch above zero.

These quantities may be represented thus:

$\gamma$ =total heat expended=1178.3 B.T.U.
q=heat of liquid=285.8.
(t—32)=284.02
h=1.78
r=heat of vaporization=892.5
p=812.1=internal work of vaporization
A.P.U.=80.4=external work of evaporization.

Stage 3.—An addition of more heat will change the steam into a gaseous condition and the temperature will rise, while the pressure which is equal to that of the loaded piston, remains constant. The steam is then said to be superheated.

All the heat expended and not shown by the thermometer during a change in the state of any substance is called latent, that indicated by the thermometer being sensible.

Notice the division of the heat of vaporization into that equivalent to the Internal Work or p, and that to the External Work Apu.

The next paper will contain a number of problems on the first five articles with their solution.

---

## IMMENSE POWER DEVELOPMENT.

The contract for the construction work involved in the Hydro-Electric Development of the Grand Falls Power Co. on the St. John river, at Grand Falls, New Brunswick, has been placed in the hands of the Frank B. Gilbreth organization, of New York. Mr. John B. McRae, of Ottawa, Canada, is the chief engineer, and Mr. Ralph Mershon, of New York, is the electrical engineer.

This plant will generate 100,000 horsepower in electric current, which will be furnished to the various cities throughout New Brunswick and Maine.

The work involves, among other features, the construction of a number of shafts in rock excavation 130 feet deep, a power chamber 30 by 260 feet and 130 feet deep, and a tail race tunnel 28 feet in diamater and 2,400 feet long, a power house 350 feet long and 260 feet wide. The intake shafts will be nine in number and 12 feet in diameter, 130 feet deep.

The plant will be equipped with the most approved hydraulic and electrical machinery for high potential and long distance transmission. Actual construction will be begun immediately and will be pushed through to completion at an early date.

The falls and water power on the St. John river at this point is the largest in eastern Canada and its development will result in the establishment of a large number of manufacturing enterprises. The total head developed will be 135 feet. Numerous auxiliary works, sub-stations and long distance transmission lines will be erected.

A large force of equipment and men will be employed and what is now a quiet village will be the scene of unusual activity in construction work.

The St. John river at Grand Falls, (which is the largest river in New Brunswick) describes a horse-shoe curve at this point and has a fall of 135 feet through a gorge of the most magnificent scenic beauty. This spectacle is second only to that of Niagara and its utilization, like that of Niagara, will result in a great increase in industrial activity in the province.

Grand Falls is situated on the Canadian Pacific Railroad about 200 miles north of St. John, N.B., and about two miles east of the State of Maine. The expenditure involved will amount to over $5,000,000.

---

## C. E. A. CONVENTION.

The Canadian Electrical Convention will hold their annual convention at Quebec on Wednesday, Thursday and Friday, July 16, 17 and 18.

E. A. Evans, general manager of the Quebec Railway, Light & Power Company, will act as chairman of the local committee, and A. A. Dion, of Ottawa, as chairman of the paper committee. A special committee on transportation has been appointed with a view to securing favorable terms from the railway and steamship companies. A splendid convention in the Ancient City may be anticipated.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## BOILER TROUBLES.

By D. S. Coules.

We often meet in with engineers who seem to have the idea of blowing out boilers at a pressure of 20 lbs. when ready for cleaning. No sooner is the boiler empty when the hoes is put into service and a cold stream of water rushed in the boiler. The blowing out of boilers while the brick work is hot enough to maintain 20 lbs. pressure is considered one of the relics of barbarism. To let the water out of a boiler while it is hot means the setting up of strains which cause great injuries also the caking and burning onto the heating surface of all the impurities and no amount of washing can remove them.

I have two 16 x 60 return tubular boilers in my charge, before blowing out I allow my boilers to cool for 24 hours. All the impurities can be easily removed and washed out and will not cake or burn to the boiler as in cases where they are blown out while hot. Of course a good many engineers cannot allow their boilers to cool more than 12 hours and in some cases less, but they should allow as much time for cooling as possible.

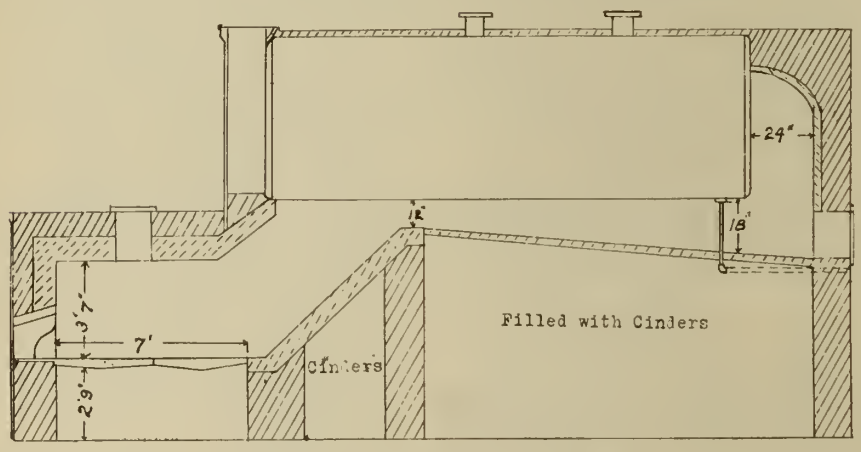



Fig. 1.—Side View of Dutch Oven.

A little over a year ago I installed two return tubular boilers for a mining company. They had an old boiler in use and doing service for about eight years. One Sunday morning I happened to go down the boiler room. The fireman was cleaning his boiler and called my attention to his boiler being badly scaled. The man-hole being removed we both went inside. To my surprise both ends of the boiler were a solid mass of hard formed scale, burnt and caked on like iron. This was in bad shape up to the top row of tubes, the front end over the fire being far the worst. I had one of the new boilers ready for service so we cut the old one out using the new one. Then we tried to get the scale out of the old one. We tried all kinds of tools but could do nothing but remove some of the tubes. Before we were through with the job we had 21 tubes out. We examined the boiler all through, thinking that perhaps the shell over the furnace might be burnt, but it was in good shape, as the scale did not lay down next to the shell but was formed from the bottom row of tubes up to the top row. We replaced the boiler with new tubes and put her in service again.

The fireman in reply to questions told me that they always blew this boiler out at 20 lbs. pressure and while he was on the job the hand-hole was never taken out. All they did was to remove the man-hole and with a set of hose wash the boiler. This forced the scale to both ends of the boiler which caused the trouble. The feed water which they were using was very hard and contained much iron mineral. No compound of any kind had been used to soften the water. Thus the scale formed much faster.

---

## INCREASING EFFICIENCY OF BOILERS.

By E. B. Phelps.

In the plant where I am employed, saw-dust from a saw-mill across the street was used for fuel. In order to burn this fuel to the best advantage dutch ovens were installed as in Fig. 1 a side view and Fig. 2 front view. When first starting to burn this fuel we obtained sufficient to supply us the year round, owing to the fires in the dutch ovens of the mill boilers being banked all night, but later on the mills company sold their exhaust steam to a neighboring concern and ran their boilers at night to supply theirs with live steam, with the result that our supply of saw-dust was cut down to such extent that we had to burn coal during the winter months. Eventually our supply got so small that it was only enough to furnish fuel for our day load.

The grate of the dutch ovens was 42 sq. ft. and when burning coal during

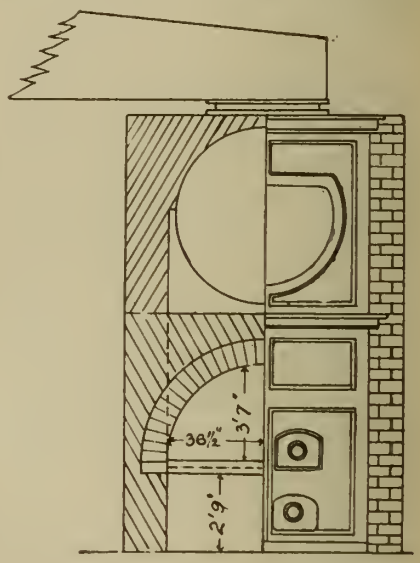



Fig. 2.—Front View Dutch Oven.

the winter months we would cut it down to 30 sq. ft. by covering the grates at the back of the furnace with fire brick. We would also brick in the feed-hole for the saw-dust in the top of the ovens. We soon found out however that the dutch ovens were excellent coal consumers and the pride of the coal dealer.

Fig. 3 gives the present lay-out of the plant.

At this point I advised the management to change the ovens of boilers Nos. 5 and 6 and proposed a new boiler No. 7 for a regular coal furnace. This arrangement gave us fuel enough for the remaining dutch ovens day and night during the summer months and

at the same time the coal when used would be burned to better advantage.

In making this change and in order to get the usual 28 or 30 inch from grates to shell we were faced with either one of two methods, viz., that of raising the floor level including the heater with its many pipe connections

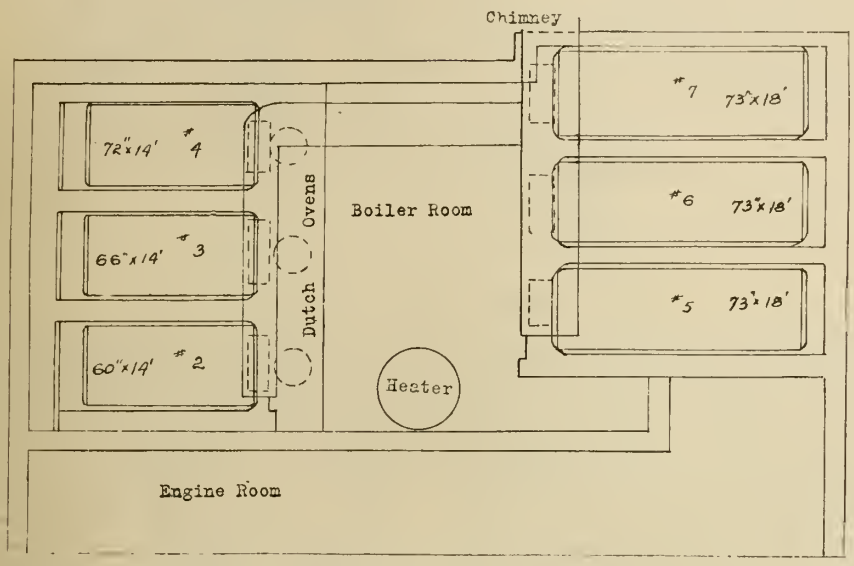



Fig. 3.—Present Layout of Power Plant.

or that of lowering the boilers on their settings which would cause the rebuilding of the connections to steam heater, water feed pipes, blow offs, etc., either method of which would prove very expensive.

I could never see the necessity of keeping the grates so close to the shell and decided to move the fronts back. keeping the same floor level and, let the grates come where they would, those in the Nos. 5 and 7 furnaces being 48 in. from shell and No. 6, 51 inch. Fig. 4 gives a side view of the furnaces of the Nos. 5, 6 and 7 boilers, as they are now. I may add in conclusion that with a slight increase of load over last year, and with the same grade of coal (slack) that these furnaces save two tons every 24 hours. An evaporative test will be run on these boilers in the near future and I will forward you the data obtained for publication.

## BLOWING DOWN.

By. S. Worthy.

The operation of "blowing" down every morning cannot be too strongly emphasized, as is shown by the following experience of the writer.

I have just recently taken charge of a steam plant, and as is my usual custom every morning, proceeded to "blow down" some. On looking at the gauge glass I thought that not very much had gone out. However, next morning I allowed the blow-off cock to stay open a little longer, with the same result. I knew then that there was some obstruction somewhere, and was anxious for the week-end to come.

The blow-off pipe is a 4-in., reduced down to 2-in., in which pipe (2-in.) the blow-off cock is fixed.

On the Saturday I attended to the boiler. It took some thirty minutes for the water to get out of the gauge glass, I was working around the engine some 30 or 40 minutes more and on going to the boiler again, I listened, and hearing no flow of water, and seeing no steam rise from the waste pipe, concluded the boiler was empty.

Imagine my surprise on loosening the front hand-hole and giving it a tap with the hammer. Out spurted the water and, by the quantity that came out of that hand-hole the boiler could not have been more than half empty.

When empty and cooled down, I took out the back hand-hole and found the obstruction. The 4-in. pipe was packed hard, right up to the blow-off cock and I had a time cleaning it all out.

The cause of the above, in my opinion, was irregular blowing down. This allowed the impurities to settle in the night. A certain amount would find its way into the 4-in. pipe, not being blown out. There being no circulation in the pipe, the same thing happens night after night, with the result that when the blow-off cock is opened, it cannot take all the sediment that has accumulated.

Since cleaning out the pipe I have had no trouble blowing down the boiler.

## SMALL TURBINES.

By W. J. Marshall.

To-day we find in certain large plants the turbine installed and the engineer must have experience with turbines to advance in his profession. The first question asked an engineer when applying for a job in a turbine plant is, "What experience have you had?"

Operating engineers should remember this and when in need of new equipment instal a turbine, even if a very small one, a blower, pump or generator. The small turbine is not an experiment any more but gives good economy and operate at small expense.

I have visited plants and seen small turbines working successfully. In one plant I visited a small turbine was installed to run a blower which it did with very little attention from the operator. There will always be work for the reciprocating engine, but the

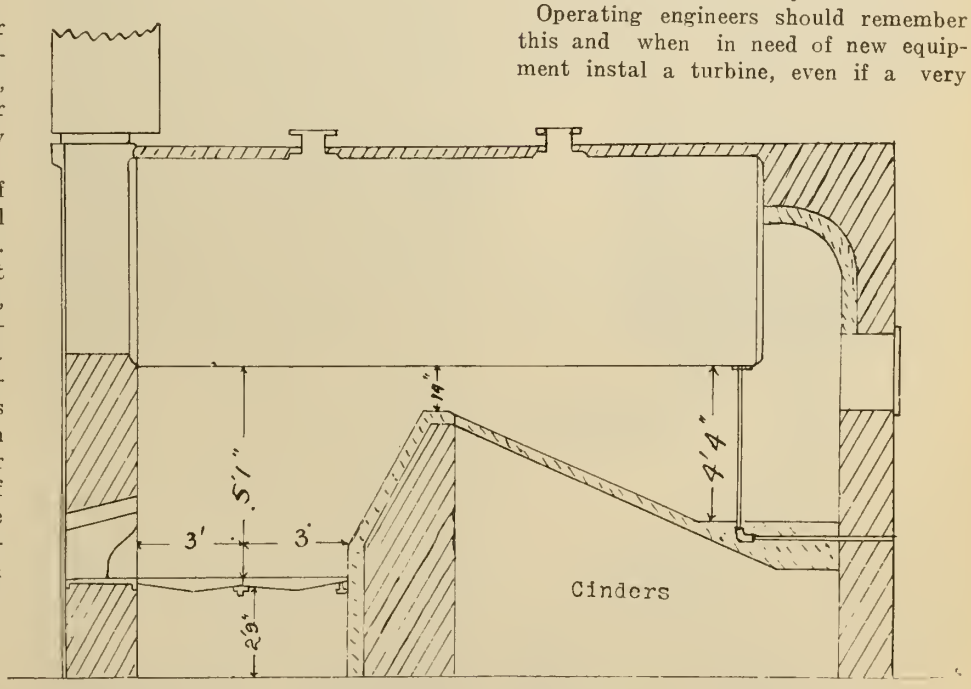



Fig. 4.—Side View of Furnace.

turbine is coming into use for certain work and it is advisable that engineers should make themselves familiar with them, both large and small units.

---

## GAS ENGINE POINTS.

By R. Manly Orr.

In view of the fact that the gas engine is rapidly growing in favor as a means of power I give the following points from my experience in the hope that they may prove beneficial to some of those who like myself are being called upon to operate them.

The first gas engine to find its way into my charge was a 50 H.P. four-stroke cycle operating on natural gas. It had been no sooner installed than it commenced to give trouble. Two of the prominent symptoms were variation in speed and after-firing. After-firing consists in a charge of gas passing through the engine without being ignited and then when in the exhaust pipe or muffler, being exploded by the hot exhaust of the following charge which has been ignited. After some study we found that the gas pressure was at fault being very unsteady. This we cured by

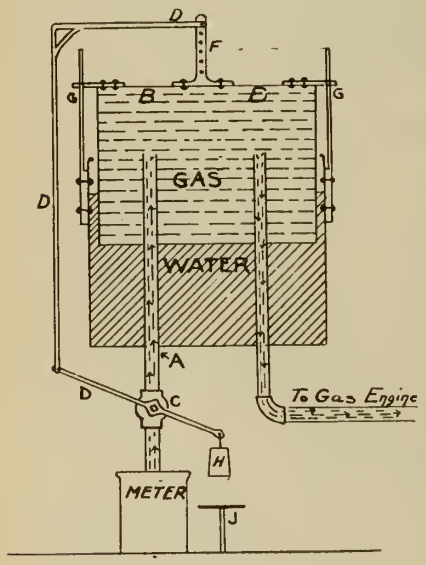



Fig. 1.—Gas Receiver.

putting in the gasometer shown in Fig. 1.

The operation is very simple. As gas comes in through the pipe A the galvanized iron top B rises and as B rises, the gas cock C is closed by the connections D. When the engine draws off gas through the pipe E, then B lowers and reopens the cock C so that regardless of the amount of gas used by the engine or the variations of the pressure at the meter, there is always a good supply at a uniform pressure in the gasometer. By use of the holes at F the height at which B will operate can be regulated. The rods G are for guiding B as it rises and falls. I added the weight H so that should any of the connections D break or work loose the weight H would fall to the stand J and thus shut off the gas.

This engine was started by compressed air and at first I used to almost empty my air tank at one starting. By referring to Fig. 2 I used to set my crank at position B. From here the crank would move off at the slightest pressure of air by the time I had the air valve open the crank had reached the position C, and the supplementary exhaust post at the crank end of the cylinder would be open also and a great charge of air would escape straight out the exhaust pipe. Now the crank should be set at position A from where it will not move till considerable pressure is behind the piston and then the air valve can be closed before the piston has gone two-thirds of its stroke which will give, with 100 lbs. of air, enough momentum to the fly wheels to compress the following three charges.

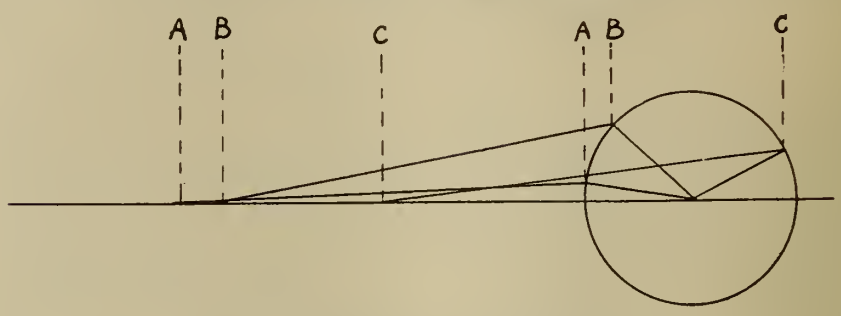



Fig. 2.—Showing Position of Cranks.

All went well for a little time and then I noticed a sort of groan accompanied by a vibration of the engine. It was some time before I found the trouble. The fly wheels, Fig. 3, are of solid rims and split hubs. With the bolts slackened, the wheels were a snug fit on the shaft and were worked to their places by revolving them on the shaft, and at the same time working them endwise. When in position and keyed I drew up the nuts with a long wrench, but this had not been sufficient and they were vibrating on the shaft. Taking the bolts out one by one I heated them to a dull red, cooled the thread and drew them up tight, while hot. When the bolts cooled and contracted this trouble had also been cured.

Fig. 4 shows a most simple governor that nearly cost me a wrecked engine. The operation is easily seen. If the engine goes above a certain speed, the weight A will not travel as fast as the rod B, with the result that the piece C will take the position indicated by the dotted lines. This will mean that the chisel D will miss the notch E and no gas will be admitted to the cylinder on that revolution. But on the next revolution the speed has fallen and this time the speed of B is such that A can come with it and the point D remains up, engages E and gas is taken in. One day the bolt F worked loose and from another part of the plant J heard by the rapid exhausts that a runaway was on. The catch G had lowered till it caught the point D at almost its lowest position and had J been a little further away trouble would surely have come.

I have now two gas engines in my plant and I have come to the conclusion that the spark plug is pretty nearly the whole engine. I find that the contact between the electrode points needs to be broken with a snap and that in order that this may be the case, the movable electrode should never be allowed to get dry in its bearing. If this is allowed to occur the action will be sluggish and the spark so weak in consequence that many of the charges will not be ignited and the speed will become uneven. I find that I am saved much trouble by keeping the movable electrode well and often oiled with good gas engine cylinder oil. No oil with a fire test lower than 450 deg. should be used. It may not be quite so economical but I do not like a hot engine. The cylinder should be kept just as hot as can be borne by the naked hand. At this temperature the wrist pin and cylinder bore will lubricate better and

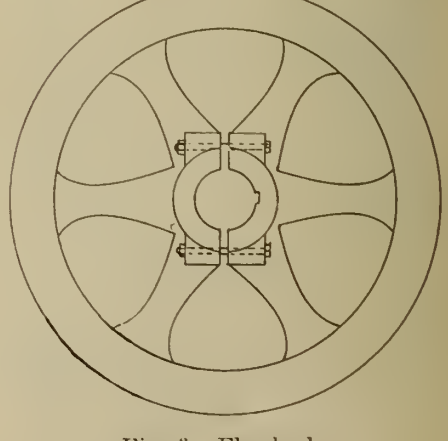


Fig. 3.—Flywheel.

the engine will I believe be more easily kept in good order.

Fig. 5 shows a simple arrangement measuring the gas pressure on the line. To a piece of board fasten two ordinary boiler guage glasses, which are to be connected at the bottom ends by a short piece of rubber tube. On the board and in between the glasses mark off a scale with spaces of $\frac{7}{8}$ of an inch. This scale is to be graduated from zero both up and down. Now fill the tubes with water till they rise to zero. Now connect one of these glasses to the gas line and the water will go down in that glass and up in the other. As shows in the Fig. 1 $\frac{3}{4}$ inch of a difference in level plus one ounce in pressure of gas. As will be seen the figures at which the water level stands will be the pressure. If a part of the water should evaporate a little should be added so that with no pressure they will balance at zero.

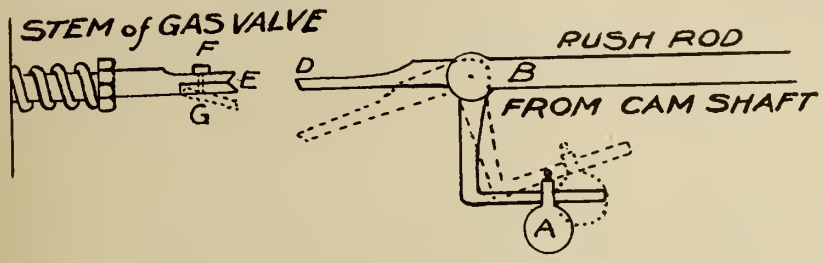



Fig. 4.—Gas Valve Stem and Push Rod.

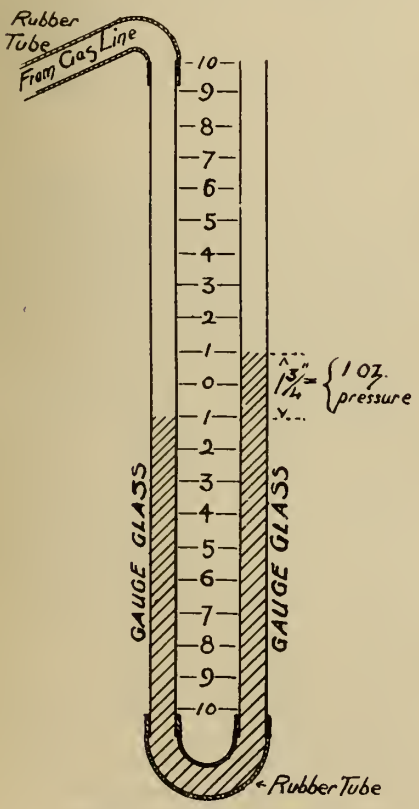



Fig. 5.—Gauge Glass.

## THE TELEPHONE IN THE ENGINE ROOM..

By W. J. Konkle.

An inter-communicating telephone system is a requisite of every modern factory. It forms the connecting link between the different departments, more especially between each department and the engine room. It serves many purposes; by its use the engineer is notified that a certain pulley is loose or a valve is leaking. It also puts him in direct communication with the supply department. In case of accident the instrument is invaluable, and it is here that it asserts its true worth. By means of a pre-arranged number of rings the engine may be shut down and immediately after this is done the engineer may be informed of the particulars and notified when to start again. All this without leaving his post.

In many engine rooms the telephone has been installed without any factor of efficiency. As there is usually considerable noise, vibration of walls and often escaping steam in a place of this kind these disturbing factors should be eliminated as much as possible.

Its location should not be more than twenty feet from the throttle of the engine. A booth will prove a great benefit as an eliminator of noise. If it is a wall instrument, there should be a piece of felt about one inch thick between the backboard and the wall and rubber washers should be used on the heads of the screws which support it. It is advisable to suspend the transmitter by means of two spiral springs fastened to an adjustable arm, or what is better, the transmitter and receiver should be fastened together and be portable. This arrangement is termed a "Microphone set." Its chief advantages are the elimination of mechanical vibration and insuring that the speaker shall be the correct distance from the transmitter.

If a booth be used the bell on the instrument should be replaced by the larger one outside the booth. In a very noisy place, there should be an extension bell at the opposite side of the room.

The engineer should remove any oil or grease from his hands before using the instrument, as this soon works its way inside and destroys the contacts, beside giving it an unsightly appearance.

If the instrument should go "in trouble," the engineer should refrain from applying his knowledge of mechanics, as the services of an experienced telephone man is the least expensive remedy.

---

## ENGINE FOUNDATIONS.

By J. A. Carruthers.

The problem of securing engines to their foundation after they have once started to move, is one that most engineers of experience have met with at one time or another, and the solution of this problem in some cases proves to be a difficult undertaking. One of the most common obstacles that the engineer is up against in this connection is the short period of time that the engine can be

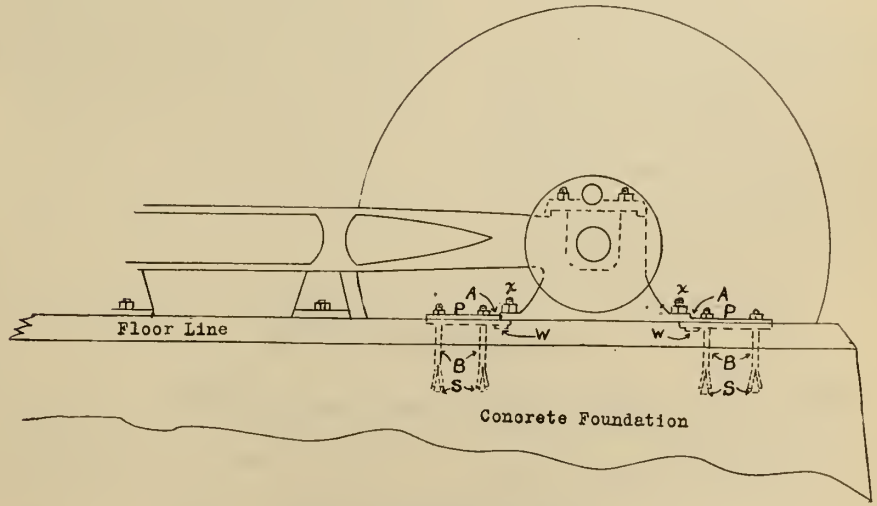



Fig. 1.—Anchoring Engine.

spared out of commission in which to make repairs.

Two of the best repairs along this line that I have yet seen were completed here about six or eight months ago, and

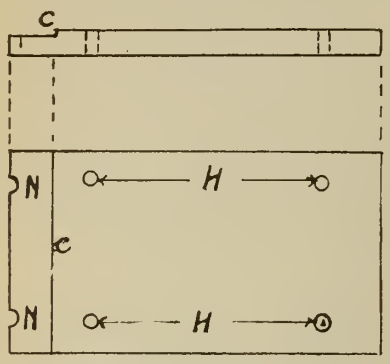



Fig. 2.—Detail Sketch of Plate.

have given perfect satisfaction. The first case was that of an 18 and 34x36 cross-compound condensing Corliss engine in tandem to a four-stage high-pressure air compressor, running 80 r.p.m. The frame was not of the sub-base type, but was supported between the cylinder and pillow block by castings under each

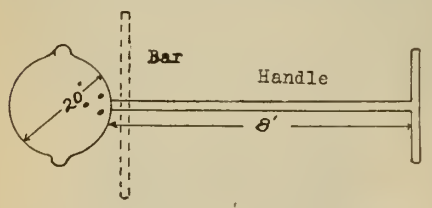



Fig. 3.—Ladle for Melting Sulphur.

end of the guides. The high-pressure pillow block started to rock a little and rapidly got worse until the end motion was almost ⅛ in. at full speed. As anyone knows who has operated air compressors, they are a hard proposition to hold down anyway.

As this compressor was required day and night continuously the master mechanic simply had to wait for a chance to shut down some day when it could be spared.

The day before this chance came, he had a couple of rock miners drill into

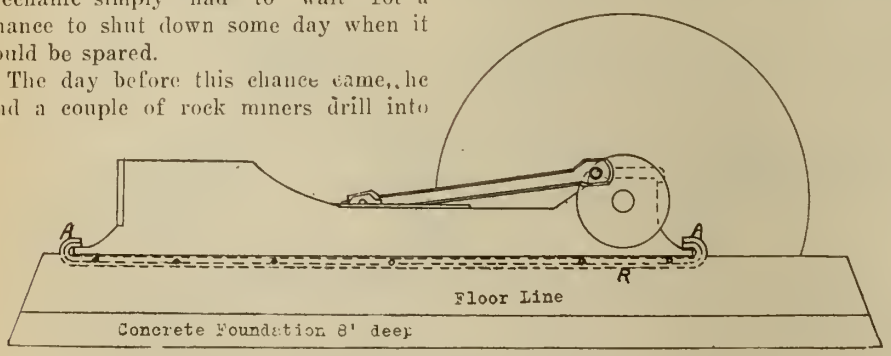



Fig. 4.—Side View Showing Rails in Position.

the concrete foundation, in front of the high-pressure pillow block, four holes about 14 in. or 16 in. deep for the bolts shown at B in Fig. 1. The concrete was also chipped out to receive the plate P, which was 1¼ in. thick by about 16 in. x 20 in., and was let in about an inch. This plate was so placed that the check shown at C, Fig. 2 (which is a detail sketch of the plate), butted against the front of the pillow, as shown at A, Fig. 1, and the notches N, N against the anchor bolts X, the nuts of which were slightly slacked. Wedges were driven under the plate at W to raise it tightly against the under side or bottom of the pillow block, and the bolts B, which were split at the ends and wedges S entered, were put in place and then hammered down to drive the wedges up to prevent the bolts from being pulled out when their nuts were tightened up. After both plates were made ready as shown in figure 1 (the back one of course had to be placed after the engine was stopped), the nuts on both anchor bolts X and tie bolts B being in place and being a moderate strain put on them, about 100 lbs. of sulphur was melted and poured in under the plates, which, of course, filled in around the tie bolts and everywhere where the concrete had been removed.

As sulphur expands slightly upon cooling, it tightened everything up in place, and by screwing up on the nuts of the anchor and tie bolts, a good solid job was secured. By those who have never used sulphur for this purpose, the greatest of care in melting it must be taken, as it will ignite very easily and is hard to extinguish. For a job like the one in question where a considerable quantity must be melted at once, it is

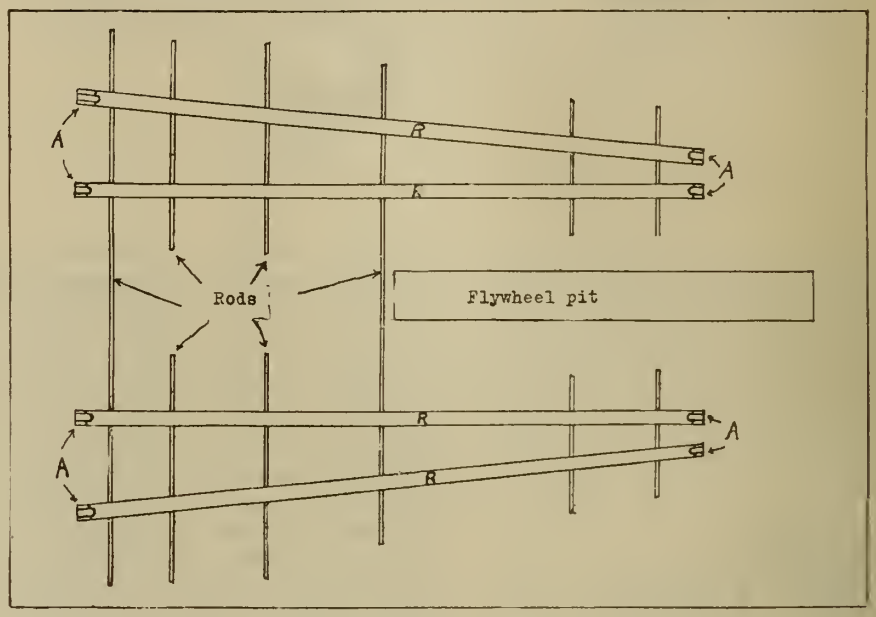



Fig. 5.—Top of Foundation.

better to have a ladle large enough to hold it all for one pouring. Fig. 3 shows the kind that was made on purpose for this particular repair. The bowl was hammered out of a piece of boiler plate by the blacksmith, and a long handle attached suitable for one man to hold. A kink was put in the handle near the bowl to allow a bar to be shoved under, for two more men to carry by. This arrangement allowed the men to keep pretty well back out of the fumes of the sulphur, which, to say the least, are not pleasant. A small portable forge was used to melt the sulphur, which does not take long—in fact, care must be taken that it is not left on the fire too long or it will thicken up again.

While the sulphur was melting, a fire of waste and charcoal was warming up the plate and concrete at the pillow block so that there would be no chilling effect when the pouring took place. The fire was hustled along by means of a piece of ¾ in. pipe attached to the air hose from another compressor. The pipe being plugged at the end and several small holes drilled in it for about a foot of its length. The whole job was done in eight or ten hours, exclusive of the drilling of the first four holes.

The second case of these two successful "hold-down" repairs was that of a

twin engine having cylinders 14x20, running at 184 r.p.m., which was 34 revolutions faster than it was intended by the builders to run. This engine had been set up on a good concrete foundation about 8 or 10 ft. deep, but owing to the increased speed and the pronounced upward pull of the rope drive, it worked so loose that it had to be cut out for repairs. As the machinery dependant upon this engine for operation had also to undergo extensive repairs, the master mechanic decided to make a good permanent job of the engine.

First of all, the engine was dismantled and taken off the foundation entirely, after which about four or five inches was chipped off all over the foundation top. When the new surface had been fairly well leveled off, the engine had been made ready for resetting under the new conditions. Four pieces of railroad track were placed under the engine, two for each cylinder and frame, and bent up at the ends over the engine bed as shown at A, A Fig. 4. The rails were placed with the bottom, or tie side, next the engine, and having been heated at each end, were bent up and over to grip the engine base securely. About half a dozen holes for half-inch iron rods were drilled through the rails before placing them in position. The engine was then set in its place, and lined and leveled up, after which cement grout was poured in and around in the usual manner.

A plan view of the rails and rods in their relative positions is shown in Fig. 5. It can readily be seen what a good anchorage effect they had on the engine after the cement grouting had hardened. After the regular anchor bolts had been tightened up, the engine was perfectly solid, as there could be no lateral or vertical movement without shifting the rails, etc., imbedded in the cement. As seen in Fig. 4, the engine is of the box frame type. As a means of eliminating the hollow thud usual with such designs, and also to make far more rigidity, a 2½ or 3-inch hole was drilled in the top of each frame between the guides, as shown at x, Fig. 4, and the cement grouting poured in until the entire interior was filled. Of course, in re-setting an engine under the conditions described, it is necessary to place the wedges for leveling up either under the rails, or under the engine bed in such positions that they will not strike the rails in being driven.

From the satisfactory results of this repair job, it seems to me that for any engine that is to be subjected to severe service, it would pay to use this reinforced method in the first place. It must be remembered, however, that when the engine is once set, it is almost impossible to move it, for purposes of alignment, etc. Hence great care must be taken in lining it up properly in the first place.

## MARINE BOILER TROUBLE.

By Irish Engineer.

I had an experience with a marine boiler last summer on a boat that I took out for a trip. I took a fireman along and we tested the boat the day previous to the trip. We went down stream, but coming up we could not raise the steam. We got the boat to land and after an examination found the boiler covered with scale. I took out a wheel-barrow load of scale and sediment.

Last fall a fireman raised a large bulge on the boiler and it was just due to letting the scale and sediment gather in the boiler. It is a fault with a number of engineers. They think they save time by not stopping to clean their boilers. I have been using a compound which gives good results, loosening scale, and believe a good compound, properly used, is a good thing, as I have found no evil effects from the one I am using.

---

## INFLUENCE OF ASH AND SULPHUR UPON BOILER EFFICIENCY.

In a recent paper E. G. Bailey, chief of the coal department, Arthur D. Little's laboratory, Boston, points out the influence of ash in coal upon boiler efficiency and shows that it depends not altogether upon the amount of ash but also upon the nature of it. Ash from certain coals, he says, has a very high fusing temperature. It is almost impossible to make any large clinker from it, no matter how much fire you have, while other coals at a comparatively low temperature (the fire not being forced) will give a very bad clinker. This has frequently been blamed on the sulphur. The sulphur itself should not take the blame, because it is a question of the fusibility of the ash.

Tar will melt at one temperature, pitch at another, lead at another, and iron at another, depending upon the fusing points of those different compounds or elements. Ash in coal is a good deal the same. It is composed of practically the same things as clay. You take an ordinary paving brick and line your furnace with it, and it doesn't last very long, but the best of fire clay will withstand a very intense heat. The ash in coal can be compared almost directly to the clay of which brick is made. Some of it contains considerable iron and other fluxes, which cause it to melt at a very low temperature and gives a great deal of trouble in burning grates, stopping the air supply, necessitating frequent cleaning of the fire, which condition cannot help but result in a lower boiler efficiency. Every time you clean the fire you lose several per cent. Your boiler is cooled and in order to obtain the previous furnace conditions, several hundred pounds of coal are required. Also, with a higher ash, whether clinking or not, the fire must be cleaned more frequently, and the percentage of loss in the coke that drops through your grate is larger in proportion to the working of the fire and the number of times that it is cleaned.

Mr. Abbott made some tests not long ago in which he showed with the same coal that as the ash was increased to 40 per cent. the boiler efficiency was reduced to zero. The United States Geological Survey made some tests at St. Louis, in which they burned some of the refuse resulting from the washing of coal. I do not have the exact figures at hand, but the ash in that refuse ran 50 odd per cent., and the boiler efficiency obtained was above 40 per cent.

Sulphur in coal is detrimental for two reasons. It is generally combined with iron, and the iron causes the clinker. The sulphur also, being liberated as the coal is burned, undoubtedly has some effect on the boiler tubes, the stack (if an iron stack is used) and the other iron work, but just to what extent this occurs I have no specific data. In a case to my knowledge, where horizontal return tubular boilers are used at mines which produce coal varying from 0.9 to 4.00 sulphur, there was no practical difference noted in the condition of the boilers. In another case, where low sulphur coal was burned, an analysis of soot and other accumulation on the outside of the tubes of a B. & W. boiler showed nearly 25 per cent. of free sulphuric acid, and sulphates of iron, showing that the tubes had been attacked more or less by the sulphur.

---

## GALT LODGE C. A. S. E. BANQUET.

The Stationary Engineers, of Preston and Galt Lodge No. 27, held their annual banquet at the home of Mr. and Mrs. William S. Fulton, Richardson St., Galt. Last year's banquet was in Preston, and according to custom this year's banquet was held in Galt. It was a most enjoyable function and a large number of engineers from both towns were present.

Mayor Mullen, of Preston, presided over the gathering, assisted by Mayor Patterson, of Galt. Short addresses of welcome were delivered by the two chief magistrates, and the evening was pleasantly spent in speeches by the engineers present, toasts and a musical programme.

The dining room was decorated for the occasion, and the ladies provided the repast. Before breaking up, a vote of thanks was tendered Mr. and Mrs. Fulton for their hospitality.

# Correspondence and Discussion on Previous Articles

We Welcome Discussion on Articles Appearing on the Previons Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### ENGINE BRASSES.

I would like to have an engineer make some suggestions how best to keep boxes right and free from pounding. The connecting rod bearing on the engine of which I have charge is the same as Fig. 7, page 29 of the February issue of The Power House.

I have tried brass and several metals but I have found nothing that will last more than a few months. The rod is very hard to get off and I find I have to file it very often to keep it from pounding.

I would also like to have opinions on how to remedy the waste from exhaust. We heat our Flour Mill by live steam and the water from it and the exhauts which means a number of barrels in a day. Our water tank is up high and as the exhaust is low we cannot make connections to the tank. I would like to hear from some engineers on the subject.

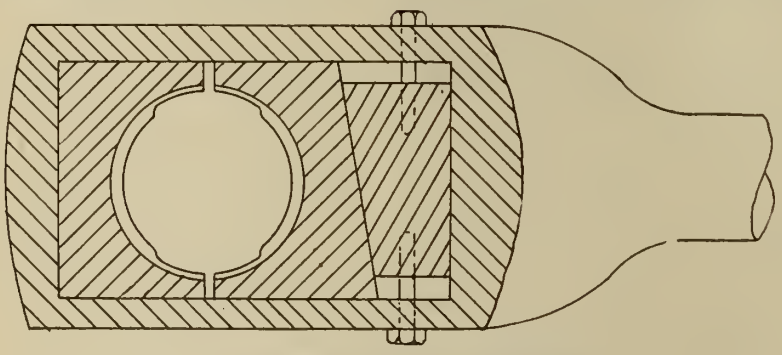
ENGINEER-IN-CHARGE.

---

Belleville, March 2nd, 1909.

I note information required by a brother engineer, re brasses similar to those shown in Fig. 7, of my article in February issue of Power House.

I herewith enclose a sketch of that



Type of Engine Brass Arrangement.

design of bearing, and might say that I have had considerable difficulty caused by brasses being short-lived, particularly in one case, where we have a vertical engine 18 in. x 32 in. running 108 R.P.M. These bearings had to be renewed every month.

We now fit our bearings similar to enclosed sketch, giving fair clearance at top and bottom of bearing, thereby reducing friction to a minimum and allowing plenty of room for a good supply of lubrication. We also cut two oil gutters from top of each bearing commencing at the centre and spreading on an angle across the bearing.

Phosphor bronze is the metal now used and one set of bearings have been in use for ten months where before they lasted only one month.

I would be pleased to give any engineer who seeks such information the address of the firm who makes this extra quality of phosphor bronze if they will communicate with me. If this quality of metal is used and fitting made as sketch, I believe the engineer's trouble will be at an end.

F. H. CHESTER.

---

### PROBLEM IN FRICTION.

In your February issue I notice "Engineer" asked the following question:—"What would be the horse-power required to move two ton up an inclined plane 60 feet long, having a rise of 17 inches in that distance ?"

Now if "Engineer" wants the element of friction taken into the problem his question is very deficient in information, for the nature of the contact between the load and the inclined plane should be known. If the contact be rollers the answer will be one thing, if the inclined plane be iron and the load simply dragged up, it will be another thing, and if the sliding surfaces be lubricated it will be still another thing.

If the intention is to discard the element of friction then we need to know nothing about the plane or its grade, the problem is simply, "What h.p. will it take to lift 2 tons 17 inches high ?"

Then, too, a h.p. is a certain amount of work accomplished in a certain length of time, i.e., it is a rate of work. Therefore, if this work is to be done in five minutes it will require a certain h.p., but if it is to be done in 2½ minutes, then the necessary h.p. will be doubled.

One pound lifted one foot equals one foot pound, and 33,000 foot pounds per minute equals 1 h.p. But 33,000 foot pounds is not a h.p.

Now 2 tons equal 4,000 lbs., and 17 inches equal 1 5-12 feet ; therefore, 4,000x1 5-12 equals 5,666 2-3 foot pounds, and 5,666 2-3 foot pounds is the power required to do this work, but the h.p. will all depend on how rapidly these foot pounds are to be accomplished.

Two engines 10 h.p. each have loads of equal size which tax them to their full capacity. One engine runs 10 hours per day, and 2 runs 1 hour per day. Now they are both doing 10 h.p. of work each, but yet No. 1 is doing 10 times as much as No. 2. It will, therefore, be evident to the engineer that the term horse-power involves the element of time.

R. MANLY ORR.

---

Re the query of "Engineer," in the February issue of The Power House, as to what horse power would be required to haul 4,000 pounds up an incline 60 ft. long and having a rise of 17 in., would draw his attention to the fact that there can be no question of horse power in this case, because there is no time limit stated. Of course "Engineer" will understand that an exceedingly small engine hat could hoist the 2-ton in say an hour's time through the medium of gears, etc., would have much too small a rating in horse p wer to be capable of hoisting the weight in say 1 minute. However, what can be estimated from the question as stated is the foot-pounds of work inv'ved in the hoisting, and also the force necessary on the hoisting cable.

"Engineer" does not state whether the 2-ton is supported on rollers, on a truck upon rails, or upon skids alone, etc., and hence the co-efficient of friction cannot be used in the calculation. The foot-pounds of work can be arrived at by any of the three following methods:

(1) Weight in pounds (4,000)×lift in feet (1.416)=5,664 ft.-lbs.

(2) An incline 60 ft. long (720 inches) having a rise of 17 inches, is equal to a

2.36 per cent. grade. Upon this grade the force necessary to move the load (neglecting friction as stated above) would be weight of load (4,000 lbs.)× grade percentage (.0236)=94.4 pounds. This force acting through a distance of 60 ft. would make the work equal to 94.4 ×60=5,664 ft.-lbs.

(3) Upon an inclined plane, the product of the weight and the lift is equal to the product of length of incline and the necessary force required to move or balance the weight. So that expressing the problem in the form of a ratio in which x=required force, we have x:

$$4{,}000::17:720, \text{ or } x=\frac{4{,}000\times17}{720}=94.4 \text{ lbs.}$$

As in example (2) this force being applied throughout the length of the incline (60 ft.) gives 94.4×60=5,664 ft.-lbs.

Hence, from any of the three examples given it is evident that there are 5,664 foot-pounds of work to be done in hoisting the 2 tons under the circumstances in the question under discussion. If it is assumed that the friction load of the engine and hoisting machinery is equal to 50 per cent. of the total, then the foot-pounds of work to be done would be 5,664×2=11,328. As work done at the rate of 33,000 foot-pounds per minute is equal to one horse power, the necessary 11,328 foot-pounds would only require

$$\text{an engine of}\frac{11{,}328}{33{,}000}=0.34 \text{ horse power,}$$

if accomplished in one minute. This would be moving the 2 tons at the rate of 60 ft. per minute, which would be considered very slow if rails and truck were used. For incline haulage with cars and rails, the car speed is generally from 500 to 600 ft. per minute, and a friction allowance made equal to from 1-30 to 1-40 of the weight of the load being hoisted.

A better understanding of the subject can be given to those engineers not familiar with this line of our work, by the solution of a typical hoisting engine problem. For example, suppose it is required to hoist 100 tons of rock per 10 hrs. up a 10 per cent. grade 5,000 ft. in length, single track hoist with winding drum 4 ft. diameter, and average car speed of 500 ft per minute. If the available boiler pressure is 100 lbs. and it is desired to use a twin engine of 15-inch stroke, what will be the cylinder diameter required? What speed will the engine have to run if it is a first-motion hoist (i.e., drum on crank-shaft)? and what horse power should the engine be?

First of all, the average number of trips per day, at the given car speed, must be ascertained. The incline being 5,000 ft. long, it will take $\frac{5{,}000}{500}=10$ minutes to hoist a trip, 10 minutes to lower the empties again, and, say, 5 minutes at the bottom to load up, and 5 minutes at the top to dump, thus making 30 minutes total time per round trip.

This would be at the rate of two trips per hour, or 20 trips per day of 10 hours. As there are 100 tons to be hoisted in 10 hours, each trip would have to hoist $\frac{100}{20}=5$ tons, which would require, say, 5 cars containing 1 ton each. If the weight of the 5 cars (empty) and the steel wire hoisting cable be taken at 5 tons (which is a close enough approximation), the total load per trip will be 5+5=10 tons.

To move this load up a 10 per cent. grade it will require a force of 10×0.1= 1 ton. To this force is added a friction allowance of 1-40 of the load$=\frac{10}{40}=0.25$ ton, or a total force of 1.25 tons.

The circumference of a 4 ft. drum is 4×3.1416=12.5 ft., and this the length of cable that would be wound on the drum per revolution of the engine. By multiplying the distance the cable is moved per revolution of drum (12.5 ft.) by the net load (1.25 tons, or 2,500 lbs.) we get the moment of load; in this case, 12.5×2,500×31,250 foot-pounds. This is the amount of work, at least, that must be done per revolution of the engine.

The work done per revolution of an engine is equal to the piston area× M.E.P.×twice the stroke in feet. With a boiler pressure of 100 lbs. the M.E.P. could be taken at about 60 lbs., the double stroke would be 1.25×2=2.5 ft., and the work per revolution would be piston area×60×25.

This work must at least equal the moment of load, i.e., 31,250=piston area ×60×2.5. Hence the piston area$=\frac{31{,}250}{60\times2.5}=208$ sq. ins. in round numbers.

Allowing 50 per cent. for engine and hoisting sheave, etc., frictional resistance, the required piston area would be 208×1.5=312 sq. ins.; this to be divided between the twin cylinders, or$\frac{312}{2}=$ 156 sq. ins. each.

This would call for the diameter of each cylinder to be $\frac{156}{.7854}=14$ inches, practically.

The speed that the engine would have to run to hoist the required tonnage, would be the average speed of the cars (and consequently, that of the cable and the drum rim speed), divided by circumference of drum, or$\frac{500}{12.5}=40$ r.p.m.

The horse power required under the given conditions would be $\frac{60\times1.25\times312\times80}{33{,}000}=5$ in round numbers.

If it were desired to increase the power of the engine so as to hoist a greater load per trip, the engine speed could easily be doubled (unless expressly designed for 40 r.p.m.), and the drum rim speed kept down same as before by either making a second-motion hoist out of it, or by substituting a smaller drum for the original one.

J. A. CARRUTHERS.

## PERFECT VACUUM.

A friend of mine who is a plumber by trade, asked me a question and I would like answers to it by engineers. The question is as follows:

"Can a perfect vacuum be formed by means of an air pump? If not, why?"

W. T. B.

## BOILER COMPOUND FEEDER.

In regard to the Boiler Compound Feeder, Fig. 2, page 31, of the February issue, there should be a valve C between the tee X and union W. Otherwise the pressure would always be on L.

WM. H. YOUNG.

## POP SAFETY VALVE.

The pop valve on my boiler sometimes gets caught fast and will not release at the proper steam gage pressure. I had it apart but found nothing wrong. I used coal oil on it and it worked all right for a while, but it often sticks and I have to release it. I would like to hear from other engineers who have had trouble with safety valves.

Another trouble I have had is in setting the valve on an automatic governor engine and I would like some information on the setting of valves.

IRISH ENGINEER.

Editor's Note—In the April issue of The Power House will begin a series of articles on setting valves on the various types of engines on the Canadian market. These will explain your second difficulty.

## BOILER AND PUMP QUESTIONS.

A return tubular boiler is eighteen feet long, actual measurement, when taken at 70 deg. F., filled with water to proper level for running. A fire is

then built and after the usual allowance for steaming is made, a pressure of 100 lbs. is obtained. What is the actual measurement of the boiler under this condition?

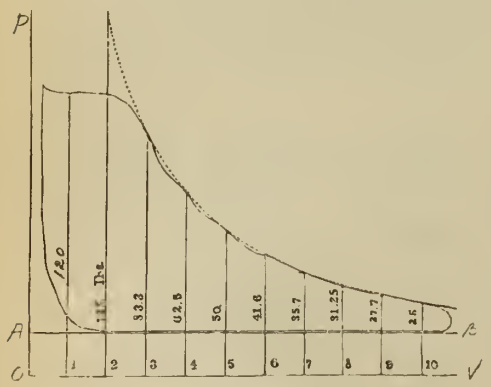
Three pumps, same size, operate at the same steam pressure. No. 1 pump takes water at its level and delivers to No. 2, which in turn delivers to No. 3, it discharging it into a pressure tank. All the pumps and the tank are practically the same level. What will the pressure gauge between Nos. 1 and 2 register, also between 2 and 3, when the tank shows a pressure of 150 lbs.?

WM. J. MARSHALL.

## MEAN EFFECTIVE PRESSURE.

Will you please give me a rule for figuring out the mean effective pressure. —Subscriber.

The subscriber has not said whether he wishes to calculate the M.E.P. from




Finding M. E. P.

an indicator card or if to obtain it from the formula for horse power..

$$H.P. = \frac{PxLxAxN}{33{,}000}$$

Where:

L=length of stroke in feet.

A=area of piston or cylinder in sq. in.

N=Number of single strokes per minute or R.P.M. x 2.

P=mean effective pressure in lbs. per sq. in.

Therefore $P = \frac{H.P. x 33{,}000}{LxAxN}$

To be accurate, one-half of the sectional area of the piston rod should be subtracted from the area of the piston if the rod passes through one head, or the whole area of the rod if it passes through two heads.

To find the mean effective pressure from the diagram, erect ten ordinates, as shown. Add together the lengths of the ordinates intercepted between the lines of the diagram and divide by their number, usually ten as in this case. This gives the mean height, which multiplied by the scale of the indicator spring gives the M.E.P. A quick way to measure the M.E.P. is to use a scale. Thus if a 60 spring is used, a sixty scale is necessary. By having a piece of tracing linen with these ordinate lines traced out trouble of drawing the lines each time is eliminated. Set the tracing over the indicator card with the atmospheric lines coinciding, and read directly. Thus:

Ordinate 1——120.95
2——125.
3—— 83.3.
4—— 62.5
5—— 50.
6—— 41.6.
7—— 35.7.
8—— 31.25.
9—— 27.7.
10—— 25.

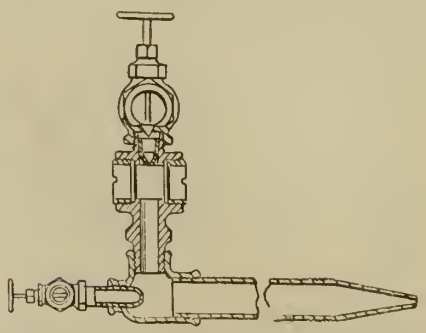
Total——603.00

Then dividing by 10 the M.E.P. is 60.3.

## GAS AND OIL BURNER.

I have noticed the letters referring to gas and gasoline burners, and am enclosing a sketch of the nozzle used on the oil gas producer manufactured by the Smokeless Heat & Power Co., Cleveland. It will, no doubt, be of interest.

Oil is fed through the upper needle valve and air through the lower one. Both air and oil are under from 20 to 30 pounds pressure. The hole through which the mixture passes is ordinarily 3-16 inch diameter and the air-hole 1/8



Oil and Air Mixing Nozzles Used in Oil Gas Producers and Burners.

inch. A sight feed glass is provided so as to check up on the flow of oil.

READER.

## MARINE ENGINEERS.

At the meeting of the National Association of Marine Engineers, February 25, held in the rooms of the Sons of England, Toronto, L. G. McCarthy, ex-M.P., was presented with a handsome cabinet of silver and cutlery, and an illuminated address in recognition of his work on behalf of the association. T. J. S. Milne, Grand President, made the presentation.

Mr. McCarthy made a fitting reply, in which he said much credit for the amendments to the Marine Act requiring all engineers to take out licenses must be given to several Quebec members of the House. A musical programme was rendered by Messrs. Fletcher, McRobert and Brickley. Speeches were made during the evening by Messrs. F. A. Corns, principal of the Dominion Engineering Academy; W. C. McGhie, chairman of the Ontario Board of Examiners; Chas. Mosely, Alex. Milne (Kingston), and J. J. Conlon, president of the Local Council.

## AUTOMOBILE AND MOTOR BOAT SHOW.

At the Toronto Automobile, Motorboat and Sportsmen's Show great interest was manifested in the various power equipments. Among the exhibitors were the Canadian Fairbanks with a complete line of gasoline engines, with both water and air cooled cylinders and supplies. One engine was equipped with lubricators of the Peterborough Lubricator Mfg. Co.

The Canadian General Electric Co. in addition to the electrical show, had on display gasolene engines, oil cups, etc. The Buffalo Gasolene Motor Co., Electrical Specialties, Schofield-Holden Machine Co., Canada Supply Co. and Anderson, Hammond & Ritchey, Toronto, had gasolene motors and supplies on display. Gray Motor Co., Detroit were also represented.

S. F. Bowser & Co. had an exhibit of self-measuring oil tanks and their use was demonstrated to the visitors.

The Chapman Double Ball Bearing Co. occupied a booth where the merits of their double ball bearings were explained and several examples of their uses shown.

## N. S. SOCIETY OF ENGINEERS.

The regular monthly meeting was held on Thursday, February 18, in Room 35 of N. S. Telephone Co.'s Building, Hollis Street, Halifax. A paper on "Ozone in the Public Health," was read by T. J. McKavannagh, Chief Electrician of the cable steamer Minia, Halifax.

The financial statement has been given out showing a balance on hand of $134.12. This is complete up to December 31, 1908.

Harry D. Bayne, Montreal, eastern manager of the Canadian Westinghouse Company, has resigned. An announcement will be made later on as to Mr. Bayne's future movements.

# Second Annual Banquet London Lodge C.A.S.E.

## The Members and a Number of their Friends Foregather in the Masonic Temple and Enjoy a Social Time and Some Interesting Speeches.

The second annual banquet of London Lodge No. 30, of the Canadian Association of Stationary Engineers was held

MAYOR STEVELY

in the Masonic banquetting hall, on Friday, February 19. The gathering was an enjoyable social function. The seemingly indigestible printed menu was greatly relished and the toasts were ably responded to by the several speakers.

MENU.

Cotton Waste—White or Colored
Mother Earth
Paper Liners Sheet Rubber
Water Gas Salinometers
Single Connection Lubricators
Asbestos Insertion Tube Expander
Deficient in B.T.U.
600 W
13,500 Units per Pound
Distorted Slide Valve Transfer Calipers
Reducing Motion Inertia Governors
Belt Laces Dirty Producer
M. E. P.
Ratio of Expansion Soda Ash
Phenolphthalein.

MR.W.NORRIS

The committee who had charge of arrangements were Messrs. Moll, Rose, Norris, Russell, Cosford, England, Rodda, Campbell, Greason and Middleton. A toast list, with many interesting speakers to reply, was provided and after the appetizing menu, President Moll in the chairman's address welcoming the engineers to the second annual banquet, called them to drink a toast to the king.

The following toast list was then proceeded with :

Canada and our Associations—A. M. Wickens.
The Legislature—Hon. Adam Beck.
Our City Corporation—Mayor S. Stevely and Alderman Ferguson.
Manufacturers and Manufacturers' Associations—F. Lawson and C. McGuire.
Board of Education—G. W. Weeks.
Executive C.A.S.E.—W. Norris.
Our Guests—G. C. Keith, J. C. Armer and A. W. Smith.

HON. ADAM BECK

In the toast to Canada and Our Associations A. M. Wickens, familiarly known as "Dad" Wickens, being one of the first members of the C.A.S.E., spoke of the great things in Canada, of the large mileage of railways and canals, great silver and nickel mines, and wheat lands. He referred to the C. A. S. E. as an educational institution, engineers and proprietors being welcome to attend the meetings of the lodges. There were so many changes and improvements in power equipment that a man must read and study to make himself a valuable man around the works. If he kept informed his employer would find him invaluable.

Hon. Adam Beck pointed out how the power of Ontario was controlled by engineers. He firmly believed in organizations if the proper spirit were manifested. He had had an experience with boilers that made him recognize the responsibility resting on the shoulders of engineers. He referred to engineers' certificates saying that the C.A.S.E. had procured part of what they wanted. By convincing the government of the

MR. G.E.MOLL.

need of grading engineers he was sure they would obtain graded certificates. He also spoke of the great developments that would follow the utilization of the water powers.

F. Lawson made a short reply to the toast to manufacturers and recited Dr. Drummond's poem, "Dominique."

The toast to the Board of Education was responded to by G. W. Weeks, who spoke of the progressive engineer educating himself. The London Board of Education is making a start at Technical Education, by introducing manual training at the High School and three other centres.

W. Norris referred to some of the plans of the C. A. S. E. executive in regard to engineers' certificates. They had not obtained all they desired from the Ontario government, and at present a man in charge of a 50 h.p. plant was

MR.F. LAWSON.

on the same footing as one operating a 500 h.p. plant. The C. A. S. E. are considering a scheme to give graded

certificates according to the qualification of the engineers. First, second and third engineers' certificates would probably be issued and manufacturers, when they found that these certificates meant something, would employ an engineer holding a C.A.S.E. certificate in preference to one who held only the government certificate. The object was partially to get engineers to know their work, to give them an ambition and make them more valuable to their employers.

Mr. Norris also referred to the C. A. S. E. annual convention to be held in London on July 27, 28 and 29. The manufacturers' exhibits will be a real education and every engineer should make it a point to attend.

G. C. Keith, editor of The Power House, referred to the convention and advocated increasing the educational feature of the annual gathering by having some engineers read papers on questions of interest to engineers generally and give them a chance to discuss the papers. The American Society of Mechanical Engineers have adopted this feature and have found it awakens a great interest in the conventions.

---

**Condensers.**

C. Pink entertained the engineers with a number of songs during the evening.

Nail these colors to the mast—"To earn more, learn more."

Mr. Fowler was very attentive to the wants of the engineers and was busy dispensing happiness—smoke up boys !

A bumper attendance, good menu and interesting speeches made it a first-class banquet.

London, July, 1909.

# At-Home of Hamilton, No. 2 Lodge, C.A.S.E.

### An Interesting Programme of Songs and Speeches, Followed by a Supper and Dance, Made an Interesting Evening's Entertainment.

The annual at home of the Hamilton Lodge, No. 2 of the Canadian Association of Stationary Engineers was held at the Thelma Club parlors, 129½ King Street, Friday, February 26. Its success sustained the reputation of the Hamilton engineers as entertainers. Arrangements were in the hands of the at home committee, consisting of W. S. Baverstock, chairman; G. W. Dawson, C. A. Leckie, A. W. Heath, H. R. Clark A. Bennington and Albert Swasy.

**The Programme.**

The entertainment was all that could be desired. G. W. Dawson, president of the Hamilton engineers, presided during the rendering of the following programme :

Chairman's Remarks—G. W. Dawson.
Instrumental Solo—Miss Culp.
Recitation—"Bishop and the Cow," Miss Jean Heath.
Address—A. M. Wickens.
Vocal Solo—Miss Culp.
Recitation — "Down on the Rio Grande," Miss Melody.
Address—W. A. Crockett.
Vocal Solo—Miss Lucy Doolan.
Monologue—Fred Mitchell.
Quartette—The Maple Four.

G. W. Dawson filled the chair very acceptably and in his well selected remarks welcomed the engineers and the lady friends. They were gathered for an evening of entertainment and pleasure, and he hoped they would make a night of it.

A. M. Wickens, executive treasurer, spoke of the engineers' certificates, pointing out that it rested in the engineers' hands to make them valuable, otherwise they are not worth the paper they are printed on. An engineer can make his certificate stand for something and make himself a valuable man around the works where he is employed.

A. M. WICKENS.

W. A. Crockett, executive secretary, in a witty speech, referred to the necessity of recreation. "All work and no play makes Jack a dull boy." The engineer should meet his brother engineers socially. It was a good idea to cultivate sociability. Mr. Crockett referred to the presence of the ladies in a very neat speech, remarking that it added greatly to the pleasure of the gathering.

Following the programme, supper was served and the next few hours were passed pleasantly in dancing. Fred Mitchell made an ideal master of ceremonies during the last part of the entertainment.

Among those present from out of town were A. M. Wickens, executive treasurer ; H. Allison, of the Ideal

W. A. CROCKETT.

Steam Separator Co., and G. C. Keith, editor The Power House, Toronto.

**Indicator Cards.**

Voice from the corner of the hall—Isn't the secretary a great orator.

The presence of the ladies added to the pleasure of the entertainment.

Miss Lucy Doolan was a whole host and responded several times to vociferous encores.

W. A. Crockett—Cultivate sociability.

---

**TORONTO C. S. OF C. E.**

The following officers were elected last night by the Toronto branch of the Canadian Society of Civil Engineers: J. J. G. Kerry, President; E. A. James, Secretary-Treasurer; a committee consisting of M. J. Haney, P. Gillespie and A. F. Macallum, and Auditors, S. Gangue and A. C. Blanchard. C. H. Mitchell, the retiring President, gave a review of the year's work, pointing out what had been accomplished.

---

M. C. Burr and H. B. Ferguson have opened up as civil, hydraulic and mining engineers, corner Abbott and Hastings Streets, Vancouver. Mr. Burr has been with the Arrowhead Reservoir & Power Co., California; the Union Construction Co., New York, and after the earthquake in San Francisco was engineer for the Water Committee. Mr. Ferguson has also had considerable experience, having latterly been with the Guggenheims in Cariboo and the Yukon.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### A NEW HYDRAULIC VALVE.

The Caskey valve is for use in air, steam or hydraulic service and has the interesting feature of becoming more effective as the pressure increases.

Figs. 1 and 2 show a valve which is used on single ram hydraulic presses. It will be noticed that there are no pockets where scale or grit could lodge and the taper plug is also absent. The valve consists of the body a (Fig. 2), the plug b, and bushing c, which is ground to fit the plug. The spring is used to insure contact between the bushing and the plug. The bushing is recessed and this space is filled with a washer. Water is admitted to the back of the washer through small port holes, pressing it out, and making a tighter and higher joint with the increase of pressure.

The construction is simple and there is no exposed seat in the valve, also, the plug being straight is evenly balanced and fluttering is eliminated. Satisfactory results are reported under working pressures ranging from 250 lbs. per square inch, with 5-in. valves, up to 10,000 lbs., with ¼-in. valves.

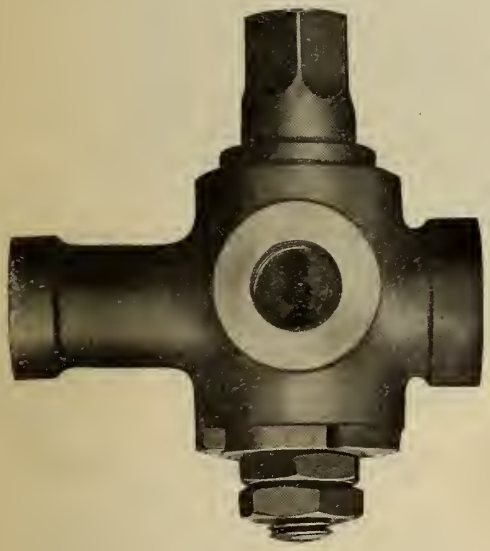


Fig. 1.—Single Ram Press Valve.

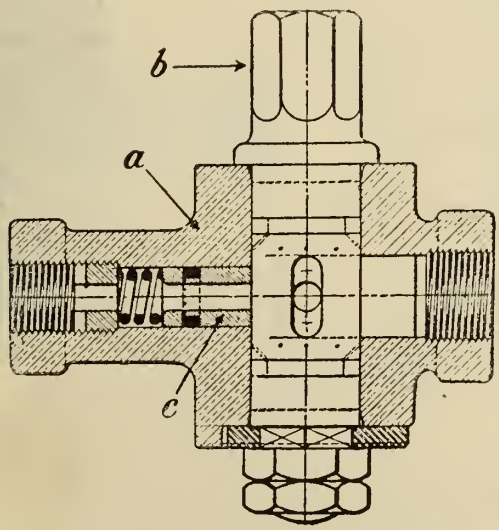



Fig. 2.—Cross Section of Fig. 1 Valve.

Fig. 3.—Locomotive Blow-off Valve.

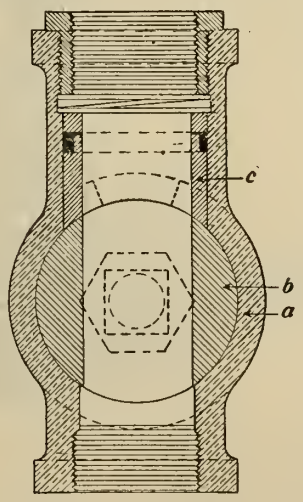



Fig. 4.—Section of Fig. 3 Valve.

Figs. 3 and 4 show the straight-through blow-off valve of this type in which positive action is one of the features claimed. Hydraulic valves of the two or three-pressure type are made on the same general principles. These are made to automatically throw on the heavy pressure at any part of the stroke in cases where the maximum pressure is not used throughout.

The general range of size of valves is from ¼ to 5-in., special sizes being made for special purposes. They are made in brass, steel or iron to suit all requirements.

These valves are being put on the Canadian market by the Caskey Valve Co., 422 Arcade Building, Philadelphia, Pa., through their agent, Alex Gibb, 13 St. John St., Montreal.

### BRISTOL'S ELECTRIC TIME RECORDER.

Bristol's new electric time recorder was designed to meet the widespread demand for a simple and practical instrument to record automatically the occurrence and duration of various operations, such as the starting and stopping of machines, the opening and closing of valves, the duration of runs, the passing of trains, etc, etc. With this recorder it is possible to record several different operations on the same chart and the recorder may be located a long distance from the points at which such operations occur.

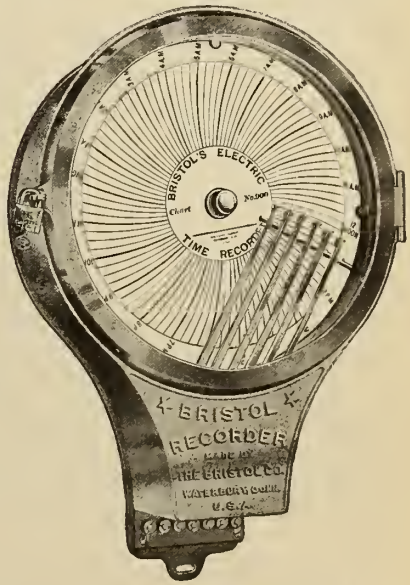



Fig. 1—Bristol's Electric Time Recorder.

These new recorders have already been used in connection with machinery to show when the machines were started

and stopped, how long they remained idle, and just when they were started again. Fig. 2 is a reduced cut of a record chart, showing complete 24-hour records of the operation of two paper machines. This record shows the time and duration of each break and also the time required to wash the felts and put on new wires.

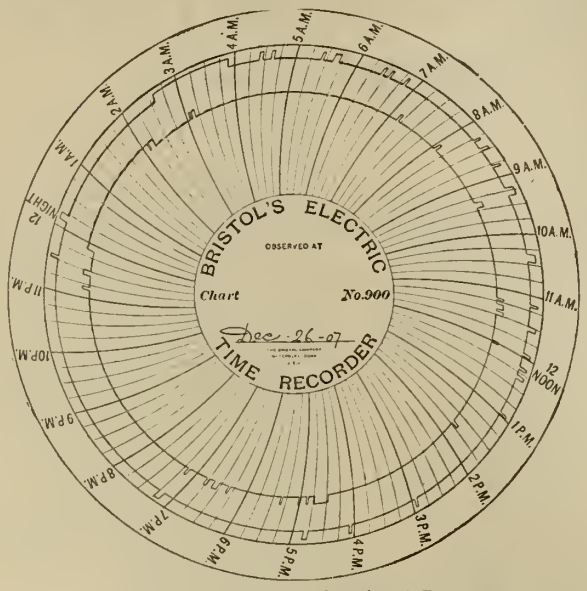



Fig. 2—Chart of Bristol Recorder.

One of these recorders arranged to record operations at six different points is shown in Fig. 1. Each one of the six pens shown on this instrument make an independent record, continuously and automatically, and in this way six different operations may be recorded on the same chart. Each pen arm is actuated by an independent electro-magnet and battery circuit, so arranged that closing the circuit causes the pen to move a certain distance on the chart.

Binding posts are provided at the base of the recorder, to which pairs of small lead wires are attached. These wires may be of almost any desired length, it only being necessary to have the object whose motion is to be recorded open or close the circuit whenever the motion occurs.

These recorders are usually operated by a battery circuit, but any convenient circuit may be employed by the insertion of lamps or other resistance to reduce the E.M.F. across each electro-magnet. The object whose motion is to be recorded is caused to make or break this circuit through any convenient contact.

The Bristol Company, of Waterbury, Conn., are the manufacturers of these recorders.

## MOTOR STARTER.

The Ward Leonard Electric Co. build a magnetic overload circuit breaker as an integral part of a motor starter for use in connection with motor driven machine tools. This independent overload circuit breaker is so interlocked with the starter that the circuit breaker cannot be closed except when the starting arm is in an open circuit position. This is the equivalent of a double pole double arm circuit breaker in that the breaker cannot be closed except when the circuit is in a protective position. Overload protection is given both during the period of starting as well as at all other times.

The greatest chance for overload in a motor circuit is during the period of starting the motor, i.e., in accelerating the motor and machine tool from the inertia of rest to the speed required. Therefore protection against overload during the starting period is very necessary.

An important feature in the design of the starter shown in the cut is that the resistance elements are absolutely enclosed; metallic chips cannot fall in and dust cannot accumulate, causing short circuits. The rheostat is of small dimensions and great overload capacity. The illustration shows a 15 h.p. 110 volt size, manufactured by the Ward Leonard Electric Co., Bronxville, N. Y.

Motor Starter.

## "MORSE AND DEXTER" VALVE RESEATING MACHINE.

The use of this machine is, as its name implies, in re-cutting worn out seats of valves without taking them from the pipe line in which they may be placed. The machine consists of a frame that is fastened to the valve casting by a universal chuck. Through the frame runs a spindle, to the lower

Fig. 1.—Reseating Machine in Use on a Globe Valve.

end of which is attached the cutter. The cutters come in different sizes to suit the different sizes of valves. They are also made to suit either flat, taper seated or Fairbanks valves.

The new and improved Dexter Patent Disc Cutter is used with the reseating machines for recutting the valve discs. The ring, to which the cutter is attached, is held in a vise by a lug, the reseating machine being attached to the ring by the universal chuck. The valve disc to be recut is fastened to a smaller chuck on the end of the machine spindle, and is given a rotary motion by turning the crank, while the pointed tool is slowly fed over the valve disc to be dressed. The tool holder has a friction bearing joint that can be adjusted to any angle for cutting a flat, oval or taper disc. These machines, in sizes for from ¼ in. to 12 in. valves, are being made in Canada by Darling Bros., Montreal.

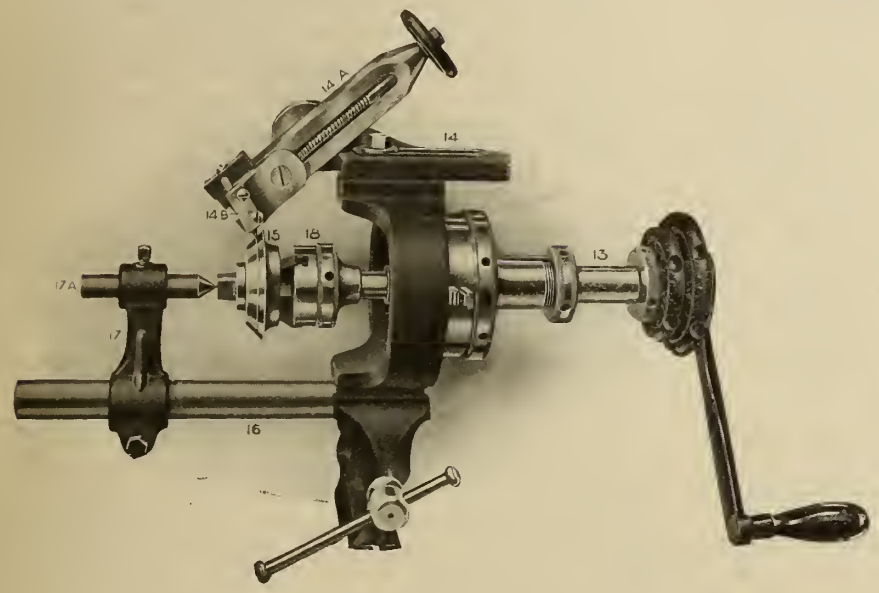


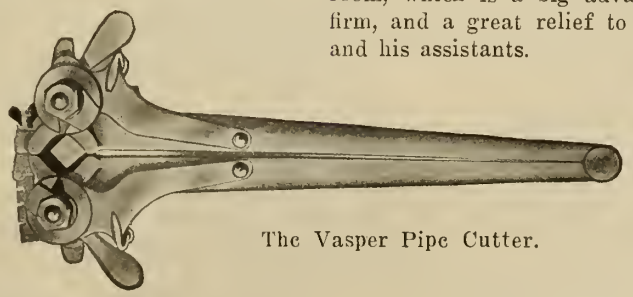

Fig. 2.—Disc Cutting Machine in Use on a Taper Disc.

## THE "VASPER" PIPE CUTTER.

In this cutter, which has a capacity of from ⅛ in. to 2 in. pipe, the bevel cutting wheels are supplanted by cutting tools that make the action of the implement the same as that of a lathe or power-driven cutter. The action is, therefore, very rapid, and there is no burr either on the inside or the outside of the pipe after it has been cut. The action also allows the cutting of thin washers from pipes.

The main frame of the tool consists of two arms hinged at the handle end and terminating at the other end in V-shaped bearings. The frame opens on its hinge and is put on the pipe and clamped there by means of an adjustable tie-bar and thumb nut. Pivoted to the side of the main frame are two knife-carrying arms, an integral part of which are overhanging lugs to which are fastened heavy coil springs. These springs actuate the feed of the knife-carrying arms. Heavy steel studs, projecting through the ends of the knife-carrying bars, hold the knives and the steel "shoes" which ride ahead of the knives to regulate the depth of the cut. The knives are circular in shape, with a segment cut out to provide the cutting edge. Eccentric levers pivoted on the knife-carrying arms enable the operator to overcome the spring tension and draw the arms so the knives or cutters will clear the pipe when placing the pipe in position. After the tool is fastened in the desired position the eccentric levers are turned over, allowing the cutters to rest on the pipe. The springs automatically feed the cutters until the pipe is cut off. The cutters may be successively reground around three-quarters of their periphery.

The "Vasper" pipe cutter, which can be used equally as well on lead pipe, brass tubing is manufactured by Macdonald & Sons, Ltd., 128 Craig Street West, Montreal.



The Vasper Pipe Cutter.

T. S. Scott, C.E., has been appointed Assistant City Engineer of Toronto, and will have charge of construction work.

## THE CARE OF BOILERS.

By D. W.

Goldie & Co., Guelph, have made a great advance in keeping their boilers free from sediment and scale. The water used in the boilers in their flour mill is taken from the Grand River that flows past their mill, and is at times very muddy.

The steam plant consists of three large boilers, only two of which are kept in constant use. The third is allowed to stand on alternate weeks so that it can be systematically and thoroughly cleaned. The theory adopted and put in operation by their engineer, Mr. Cunningham, is that it is not possible to clean a boiler in one day, but requires to be done carefully and well.

Following his method, the boiler not being used the following week, is allowed to stand over Sunday. On Sunday night or Monday morning, the boiler being cool, the water is run off. The boiler is then filled with cold water which is again run off. The man-hole cover is then removed enabling the operator to get inside with a hose and thoroughly wash the tubes from the top. This could not be properly done if the boiler was hot. The secret of getting the boiler well cleaned is to let it stand long enough to get thoroughly cooled. Otherwise it would have to be washed from the hand-hole in the bottom, and as most of the mud and sediment collects on the top of the tubes, the water would not wash it off as it should.

Another point of advantage in this method is that it is not necessary to blow the boiler down when it is hot nor fill a hot boiler with cold water which is very injurious. It has not been found necessary to use any boiler compound and only soda is used. One of these boilers has been in use for twenty years and looks as if it was good for another twenty years' service. This system does away with Sunday work in the boiler room, which is a big advantage to the firm, and a great relief to the engineer and his assistants.

## ONE OF MANY.

Dear Sir,—I received The Power House in good shape. and must say that I am pleased with it. I will do all I can to help you make it a success.

Enclosed you will find a contribution which I trust you will find satisfactory. In a short time you should have quite a list of the boys represented in your "Practical Letters Department."

You are to deduct $1 from my cheque for this article. and send me The Power House for one year.

R. MANLY ORR.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*

*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960, J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe, 933-935 Monadnock Block
NEW YORK - R. B. Huestis, 622-624 Tribune Bldg. Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas, 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II MARCH, 1909 No. 3

## CONTENTS

Central Power House Equipment G.T.R. Shops, Stratford 9
Leaky Man-Holes in Boilers - 10
Oil as a Marine Fuel - - 11
A Modern High Speed Turbine Pump Instalation - - 12
Revelstoke Gas Producer Plant 16
Putting Gasket on Pump - - 16
The Distinctive Features of Two-Cycle Gas Engines - 17
Course of Lessons for the Instruction of Stationary Engineers - - - - 18
Immense Power Development 19
C.E.A. Convention - - 19
Practical Articles by our Readers 20
Boiler Troubles.
Increasing Efficiency of Boilers.
Blowing Down.
Small Turbines.
Gas Engine Points.
The Telephone in the Engine Room.
Engine Foundations.
Marine Boiler Trouble.
Influence of Ash and Sulphur Upon Boiler Efficiency - - 25
Galt Lodge C.A.S.E. Banquet - 25
Correspondence and Discussion on Previous Articles - - 26
Engine Brasses.
Problem in Friction.
Perfect Vacuum.
Pop Safety Valves.
Boiler and Pump Questions.
Mean Effective Pressure.
Gas and Oil Burner.
Marine Engineers - - 28
Automobile and Motor Boat Show - - - - - 28
N.S. Society of Engineers - 28
Second Annual Banquet London Lodge C.A.S.E. - - 29
At Home of Hamilton No. 2 Lodge C.A.S.E. - - - 30
Toronto C.S. of C.E. - - 30
New Equipment for Power Plants - - - 31
A New Hydraulic Valve.
Bristol's Elec. Time Recorder.
Morse and Dexter Valve.
The Vasper Pipe Cutter.
The Care of Boilers - - 33
Editorial - - - - 34
Locomotive Boiler Design - 36
General A.C. Information - 36
Trouble with Large Commutator 36
Power Plant Developments - 37
Power Supply Markets - - 38
Catalogues and Book Reviews 38

### THE ADVERTISING PAGES.

Have you carefully considered the value of the advertising page? It is true that the acceptance of advertising by the publishers of papers, enables them to place their publications in the hands of a subscriber at greatly reduced rates. But this is only an incident. That is not the great benefit to be obtained from the advertising pages. Engineers have told us that they owe their positions solely to information gleaned from advertisements and catalogues, while serving as firemen in power plants. They subscribed to a power paper and read the descriptions of different boilers, engines and other power house apparatus. They sent for catalogues of the various makes and studied their construction and good points. In the different advertisements of the paper, condensers, air compressors, pumps, heaters, etc., were described and the knowledge learned from this source, supplemented by that of the catalogues, obtained by writing the makers, placed these firemen in a position to take charge of their plants when their respective engineers were away and later when the engineers left to take charge of larger instalations, these firemen were in each case found capable of filling his chief's position.

One engineer told us his whole story. He used to watch a sight feed lubricator every day feeding from the bottom. This seemed funny to him until he noticed one advertised in his paper and sent for a catalogue. In it was a full description of a sight feed lubricator. He found when he wanted to order pipe couplings, elbows or boiler accessories he had to study out the catalogues, and he learned to send for those mentioned in his technical paper, both in the advertisements and under catalogue reviews. He found the companies not only willing, but anxious to supply him with a catalogue and any other information within their power

Every engineer and fireman who hopes to earn advancement will find it to his great advantage to study the advertisements, get the circular matter and study the makes of engines, etc., mentioned.

Every user of power should also study the advertisements and send for catalogues. At any time you may be called to increase your power equipment and an intelligent knowledge of power equipment will help you to place your order at once for the most efficient machinery for the purpose required. By studying the advertisements and keeping informed on the machinery on the market, you will probably save yourself hundreds and perhaps thousands of dollars when you are in the market to buy. Then when the new engine, pump or condenser, etc., arrives you do not have to tear it all apart to learn its construction. You understand it before you order it. Your engineer who also keeps informed understood it before he recommended it, and, therefore, you have something both your engineer and you as proprietor thoroughly understand.

The advertisements are a valuable source of information which should be perused each month. Every user of power, every engineer and every fireman will find by reading these pages in The Power House, advertisements of various types of boilers, engines, pumps, fittings, etc., containing a lot of valuable hints and information. Send for descriptions of this machinery. The advertisers will be pleased to furnish you with catalogues, circular matter, etc, and you will glean from them a knowledge that will some day be invaluable to you, and you will then thank the advertisements in your paper.

## DON'T BLAME THE MACHINE.

Frequently a salesman, when going back to customers who have purchased machines or an engine from his house, will be confronted with the tale of woe that "the machine doesn't work right" etc. They consequently blame the machine first thing, without giving a thought to the consideration of hurtful outside agencies. These outside causes of dissatisfaction sometimes are very simple to remove and in one case which has been brought to our attention, the trouble was caused by graft, pure and simple. The oil that was being used was delivered under a false name as to quality, aad was absolutely of no use for the purpose for which it was intended. Although attention was called to this fact, the purchasing continued. Why? Because "somebody" was making a "good thing" out of it with little or no regard to the welfare of the machines upon which the oil was used nor the quality of work done by the machines.

Now, there can be no blame attached to the machines in these cases, no more than to the horse which does poor work on a diet of nothing but water. The fault lies solely at the door of those who purchase regardless of requisitions prepared by the men-in-charge, who know what they need.

Engineers and machinists should therefore be on the look out for this sort of "grafting" and expose it at once, because it is on them that it reflects. The engineer gets decreased efficiency in his plant and the machinist decreased output or an output of lesser quality. All concerned would be infinitely better off if this method of purchasing could be wholly eliminated and one of the most effective ways to start this elimination is to begin at the bottom and fearlessly expose the smallest attempt at purchasing "bad" under the guise of "good."

## ART AND AD DEPARTMENTS.

That the advertisements in The Power House are attracting widespread attention is seen by the fact that many of them are being copied word for word by other technical journals. Even the illustrations are reproduced to suit the article advertised.

This circumstance goes to show the efficiency and capability of the ad. writing and art department connected with The Power House, and that the advertisements contained therein can be relied upon to command the attention of readers when they so forcibly attract the eye and reason of the critic.

## NEW G.T.R. SHOPS, STRATFORD.

A description of the power plant of the new G.T.R. shops at Stratford appears in this issue. An interesting feature in the new machine shop is the application of individual motor drive to all the large machine tools. A 220 voltage direct current, is used throughout the shops. All the large machines formerly driven by belt from line shafting are having individual motors attached. Another feature in connection with this system is that chain drive is used to connect the motor to the machine tool.

## TOPICS OF THE MONTH.

The social engineer has been in evidence during the past month. It does an engineer good to rub shoulders occasionally with men in the same profession as himself. Take Eecutive Secretary's advice and cultivate sociability.

* * *

Another proposition has been made to the government by the Long Sault Development Company, an American organization which last year asked the Government for permission to develop power at the rapids at Cornwall. There can be no doubt as to the available water power but transportation is important and must be taken into consideration before any concessions are made.

* * *

Two manufacturers of power equipment are each making improvements in their products. Each has his eye on the other, bound to have the best of the market. The result is that satisfactory advances have been made by both manufacturers and users of power equipment will reap the benefit of this tilt of mechanical brains. A full description of these improvements will appear in an early issue of The Power House.

* * *

It is now proposed that the National Transcontinental Railway use a steel tube under the St. Lawrence instead of a bridge. J. S. Armstrong has presented a scheme to the Montreal Board of Trade, consisting of a tube covered with concrete and held in place by piers, similar to the one at Port Huron. The building and placing in position of the tube to hold the four lines of railway and two driveways for passengers, necessary to handle the traffic at this point, would present some engineering difficulties that would need to be worked out. These, with the probable cost, are matters for consideration.

* * *

A Midland man has been charged with attempt to blow up the boilers of the Canada Iron Furnace Company's iron smelting works at that point. The water supply had been shut off and the arrest followed. The feeding of water from water mains should be discouraged. In fact, a law compelling the use of barrels or tanks from which to feed the boilers would eliminate any chance of explosion caused by unscrupulous people tampering with the valves on feed-water pipes. Even if operating engineers exercise the greatest care there is always the possibility of water being shut off for repairs and the results would be serious.

* * *

The harnessing of the Bay of Fundy tides and utilizing the power to generate electricity is the object of a company seeking a Dominion charter. Many schemes have been previously proposed and the outcome of the present one is being watched with interest. The scheme provides for extensive dams, which incidentally will give Moncton a fine deep water harbor and a large power plant on the Petitcodiac River. Another large plant will be located at Amherst, N.S., and others on the Bay of Minas. The rising and falling of the tide in Petitcodiac River represents an energy of about 3,000,000 horse power per day, but only a small portion of this can be utilized continuously, the Moncton plant being designed to develop about 100,000 horse power. It is not proposed to operate at St. John at present, as the range of the tide at that place is very much less than at the head of the bay.

## LOCOMOTIVE BOILER DESIGN.

The accompanying table may serve as a guide to designers of locomotive boilers whether stationary or otherwise, as it gives most of the prominent ratios occurring in the best English, French and American design.

**Boiler Ratios of 8 Locomotives Used by the Pennsylvania Railway in tests made at World's Fair, St. Louis.**

Locomotive N°1499 × Simple. × - Freight.
" N° 734 × " . ° Passenger.
" N° 585 × Schenectady 2 Cylinder Compound.
" N° 929 × Baldwin Tandem Compound.
" N° 535 ° Vauclain 4 Cylinder Balanced Compound.
" N° 628 ° Hanover 4 Cyl. Bal. Comp. with Superheater.
" N° 3000 ° Cole 4 C.B.C.
" N° 2512 ° De Glehn 4 C.B.C.

| Number of Locomot's | Clearance in % Piston Displ't H.P. Cyl. | Clearance in % Piston Displ't L.P. Cyl. | Ratio of Cyl. Volumes | Sq ft air inlets to Sq ft grate | Boiler Volume Cubic feet | Steam space in boiler with water at 2" cock Cu ft | Steam space in boiler with water at 2" cock % boiler vol. | Ratio heating surface, fire side to grate surface | Ratio fire area thru tubes to grate area | Ratio firebox heating surface to grate surface | Ratio tube heating surface (fire side) to firebox do. | Ratio of firebox vol. to grate area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 929 | 17.14† | 8.37† | 2.79 | .1274 | 657.4 | 94.60 | 14.39 | 73.73 | .147 | 3.70 | 18.90 | 5.36 |
| 585 | 16.68† | 5.71 * | 2.32 | .1614 | 373.2 | 71.37 | 19.12 | 57.03 | .124 | 3.35 | 16.01 | 3.60 |
| 1499 | 11.29 * | | | .0774 | 443.39 | 78.66 | 17.74 | 50.44 | .124 | 3.38 | 13.91 | 4.52 |
| 734 | 9.26 * | | | .1445 | 421.73 | 79.91 | 18.95 | 75.27 | .169 | 6.48 | 10.61 | 6.49 |
| 3000 | 16.87† | 6.52† | 2.84 | .0972 | 409.07 | 77.41 | 18.92 | 60.12 | .136 | 3.04 | 18.77 | 4.41 |
| 2512 | 13.27 * | 9.75 * | 2.82 | .1422 | 295.85 | 75.69 | 25.58 | 79.56 | .141 | 5.31 | 13.98 | 5.40 |
| 535 | 18.57 † | 6.58† | 2.78 | .1342 | 489.35 | 54.85 | 11.21 | 60.01 | .123 | 4.56 | 12.17 | 5.84 |
| 628 | 11.72 † | 10.32 * | 2.47 | .1142 | 245.30 | 58.08 | 23.67 | | | | | |

† Piston Valves.
* Slide do.

## GENERAL A. C. INFORMATION.

The current of A. C. apparatus is always given as amperes per phase and can be computed from the following formulas:

$$\text{Single Phase Amperes} = \frac{\text{K. V. A.}}{\text{Volts}}$$

$$\text{Two Phase (4 wire) Amperes} = \frac{\text{K. V. A.}}{2 \times \text{Volts}}$$

$$\text{Three Phase (3 wire) Amperes} = \frac{\text{K. V. A.}}{1.73 \times \text{Volts}}$$

**Size of Generator Required.**

$$\text{For Lighting, K. V. A.} = \frac{\text{No. of Lamps} \times \text{Watts per Lamp} \times \text{Load Factor}}{1{,}000 \times \text{Power Factor}}$$

$$\text{For Power, K. V. A.} = \frac{746 \times \text{Horse Power} \times \text{Load Factor}}{1{,}000 \times \text{Efficiency of Motors} \times \text{Power Factor}}$$

Watts per lamp and efficiency of motors vary considerably, and if not known approximately must be obtained from the manufacturers.

The load factor is the maximum percentage of the total connected load that is likely to be used at any one time. It varies with the character of the load, from 40 per cent. to 90 per cent.

The power factor, which enters into all alternating current calculations, is the ratio between the true power (kilowatts) and the apparent power (kilovolt-amperes). It depends upon the character of the load. The power factor is high in a system containing only incandescent lamps. An inductive load, such as arc lamps, induction motors or other apparatus requiring magnetising current, reduces the power factor. This important factor must be considered in selecting the proper size of alternating current generator, otherwise the excess of wattless current may overload the generator, but not the engine.

$$\text{Power Factor} = \frac{\text{K. W.}}{\text{K. V. A.}}$$

**Size of Engine Required.**

Brake h.p. of engine = approximately $1\frac{1}{2} \times$ k.w. of generator or, approximately $1\frac{1}{2} \times$ KV.A. of generator × power factor.

## TROUBLE WITH LARGE COMMUTATOR.

A writer in the Electrical World tells of an instalation of a 1,000 kw. 16-hole shunt-wound direct-current dynamo, direct-coupled to a Bellis engine of the triple-expansion type, in which he was interested. The commutator gave trouble from the start, and although it was trued up several times it would not remain concentric with the shaft and invariably became slightly oval in section.

A time was ultimately reached when tightening could have no possible effect —i.e., when all the clearance, shown at A in Fig. 1, between the following ring and the commutator sleeve was exhausted, and it was necessary to disconnect the commutator from the armature winding and to take the commutator and sleeve off the shaft. The sleeve was then withdrawn in order to investigate the trouble and it was found that the flange of the sleeve proper was badly cracked at B, through 3 in. of unsound metal, and for more than half its circumference. The ring, or flange, had apparently been pressed out of position, after being cracked by the frequent tightening of the clamping bolts. It is obvious that had there been no limit to the clearance between the follower and its shoulder in the sleeve, it would have been possible to have pressed the back flange entirely off, or to have distorted it sufficiently to cause a fracture all round. The sleeve was put in the lathe and turned down as shown in Fig. 2, and a steel ring was forged, turned and bored and shrunk on as shown, and held against all possible distortion by twelve 1¼ in. steel screws.

The commutator segments, which had been safely clamped with circumferential bands before the sleeve was extracted, were also put in the lathe, and their cones truly turned. All the parts were then put together, with proper clearance assured at A (for tightening purposes), and the commutator was then turned in its place on the armature shaft. For this purpose the engine was run under its own steam at 13 revs. per minute, giving a peripheral speed to the commutator face of 195 ft. per minute.

For the purpose of supporting the compound slide-rest employed, two sets of brushes were removed from the heavy cast iron brush ring and two of the bolt holes were improvised for fixing an angle plate to. As there was no room for the bottom slide of the compound rest, a special tool-bar, having tool adjustment for "feeding in" the cut, was provided.

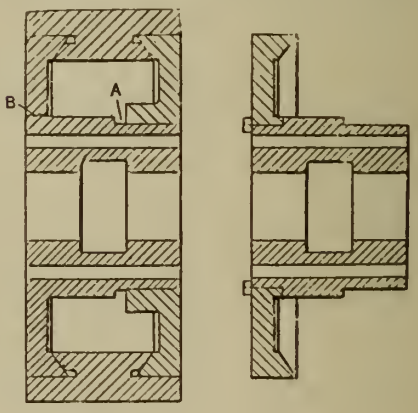



Fig. 1. Fig. 2.

Three cuts were taken, and the commutator was finally buffed with emery cloth carried on a curved wooden block. The whole work of turning the commutator—which was 13 in. long and 5 ft. in diameter—was accomplished in 15 hrs. No trouble has since occurred.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Electricity and Steam.

Armstrong, B.C., has decided to buy an electric lighting plant at $24,000.

A local telephone joint stock company has been formed at Carieville, Sask.

The Stoney Beach Rural Telephone Company, Belle Plaine, Sask., has been incorporated.

The Moncton city council will receive, until March 20th, tenders for an electric turbo pump.

Permission has been given to Dr. Greenwood, of Sutton, Ont., to construct a telephone line from Sutton to Ravenshoe.

The Grand Trunk Pacific will install electrical generators to supply light and power in their building at Melville, Sask.

The Canadian Northern Railway is preparing to electrify its shops at Winnipeg, using power from the street railway's plant.

The electric light plant at Wingham, Ont., went under new management on March 1, when L. B. Ramsden, Port Colborne, took charge of it.

A by-law granting a franchise to F. Laidlev for the instalation of an electric light and gas plant has received its second reading at Swift Current, Sask.

The owners of the Sourdough Mine, 40 miles from Dawson, propose to buy the local plant and supply light, power and telephones to the whole district.

Tenders for heating apparatus, public building, Kincardine, will be received until Friday, March 19th, 1909. Address, Department of Public Works, Ottawa.

City Electrical Engineer Aitkens, Toronto, is preparing the specifications for the municipal electric plant, with a view to advertising for tenders in a few days.

The deal was closed in Montreal recently for the financing of the Stave Lake Power Company's project. The proposition is to develop the falls on the Stave river.

Tenders will be received by A. St. George Hawkins, Listowel, for the equipment of the municipal electrical system of Listowel. The plant will include steam-driven generators.

The Tilbury, Ont., Telephone Co. has been granted a 20-year franchise by the council, the price of phones not to exceed $12. About 35 miles of rural line will be constructed in the spring.

The Hinton Electric Company, Victoria, is instaling a new electric lighting plant in the saw mill at Chemainus. The generator will be of 115 kilowatts, carrying 2,000 volts. It is an important point that this company now uses the product of a plant on the west coast of Vancouver Island, for its switchboards.

Tenders will be received up to noon on March 16th, for the supply of cast iron water pipe for Toronto, for the year ending April 1st, 1910. Also for the laying and jointing of pipes, valves, hydrants, special castings, etc., up to 31st of December, 1909. Address, Joseph Oliver, Mayor, chairman Board of Control, City Hall, Toronto.

A contract has been entered into at Saskatoon providing for the construction of an electric power transmission line two hundred and fifty-two miles in length, all or the greater part of which will it is expected, be completed by the end of the year. Within the past two months upwards of thirty-five municipalities have voted in favor of procuring power from the Hydro-Electric Commission.

The Levis municipal council has just closed a contract with the Canadian Electric Light Co. for the operation of its system of waterworks. The actual cost to the town by working its steam plant is in the vicinity of some seven or eight thousand dollars. The company supplies one thousand horse-power to the north shore by means of a powerful cable laid across the St. Lawrence, opposite Quebec. The company is exclusively Canadian.

The Seymour Electric Power Company, Campbellford, Ont., has begun operations in connection with power development at dam No. 1 above the town. The company intend to push the work to completion so as to be able to put their power on the market at the earliest possible moment. 4,000 horse-power will be developed. Contracts for the important machinery have already been made with the Canadian Westinghouse Mfg. Co., the Canadian General Electric Co., Wm. Kennedy & Sons and the General Electric Company, of Sweden.

An amicable arrangement has been arrived at between the B. C. Electric Co. and Victoria, by which the city will drop its application to the Legislature for authority to enter into the electric power business, and the company in return will agree to enter on an exclusive scheme of development which will include the development of the Jordan river scheme, in which not less than $250,000 will be spent, and power to the amount of 10,000 horse-power be provided whereby great extensions to the company's system in and about Victoria will be made. The arrangement will place Victoria on the same favorable basis as Vancouver.

The People's Railway Company have not yet awarded any contracts for the construction of the proposed overhead electric railway which is to connect Stratford, Berlin, Guelph and Woodstock, by way of Hamburg, Berlin, Fergus and Elora. The system will have about 18 miles of single track. It is the intention of the company to begin construction in April. Power will be purchased from the Hydro-Electric Company. The repair shops will probably be located at New Hamburg. The company has applied for a charter. Capital, $1,000,000. Headquarters are at Toronto, Ont. Directors are, N. R. Bugg, Bright, Ont.; W. A. Bugg, Joseph McNeil, A. N. Warfield and J. H. Wood, Toronto.

The Government has started to get matters into shape for the erection of the dams at Dog Lake, back of Port Arthur. To this end H. G. Acres, hydraulic engineer for the Hydro-Electric Commission, is making the necessary concluding surveys preparatory to starting the work. A. L. Russell, who already has done the preliminary work and furnished the Commission with plans and detailed information with respect to the lake, river and grounds surrounding, accompanies Mr. Acres and participates in the work being done. In addition to building the dam, the outlet of the lake will be lowered, by blasting out the channel to a depth of some three feet, thus enabling the drawing off of considerably more water. We understand that instructions have been given to have the necessary roads cut out for taking in supplies to the site of the work.

The B. C. Electric Company before developing its Jordan river power proposition is seeking an agreement with Vancouver similar to that asked last year. In brief, the proposal is that Vancouver go on with its application to get the right to deal in power and light, at the same time inserting a provision by which the city, should it choose to exercise this power, shall first offer to buy out the company. Provided this is agreed to the company will undertake to erect a power plant with a capacity of not less than 10,000 horse-power, and will make extensions of the electric railway and light and power systems in and about Vancouver; the sum of a quarter of a million at least being spent within three years. The rates for electric light and power, it is agreed, shall not be higher than in Vancouver at the present time, and for the city lighting the company will supply to the municipality at its power house all the power required at half the rate it costs the city to generate it now. The company further agreed to take any surplus water from the city for power purposes. The company's expenditure on the Jordan river plant is estimated at $1,500,000. This is probably less than it will cost, and this will be expended in addition to the quarter million in extensions in and about the city.

Tenders calling for an expenditure of $750,000 were accepted recently by the Hydro-Electric Power Commission for the equipment of the different distributing and transformer stations in connection with the Provincial Niagara power scheme. The amount mentioned is one-third less than the estimates. This is the second great step in connection with the carrying out of the Government's power policy, and the only remaining contract to be let is that for the erection of the buildings. The contract for the provision of the equipment is to be divided between the Canadian General Electric Company, which gets two-thirds of the whole, and the Canadian Westinghouse Company, which gets one-third. The accepted tenders affect the equipment of twelve stations. The chief will be the stepping-up station at Niagara Falls, and the others will be situated at Dundas, the interswitching station for the whole system and the transformer station for Dundas, Hamilton and Waterdown; Toronto, supplying West Toronto, Milton, Acton, Brampton, Weston and Mimico; Guelph, Preston, supplying Galt and Hespeler; Berlin supplying Waterloo, Elmira and New Hamburg; Stratford, St. Mary's; London supplying Port Stanley; Woodstock supplying Ingersoll, Tillsonburg and Norwich, and Brantford supplying Paris, St. George and Ayr.

## Gas Items.

Bruce, Stewart & Co., Charlottetown, P.E.I., is putting together fifty gas engines. These engines were all cast and milled by the firm.

The Diamond Gas & Engine Co., Ltd., Toronto, have recently shipped a 250 h.p. gas producer plant to the Coniagas Mine, Cobalt.

Dickert & Broom, Woodstock, Ont., have purchased an acetylene gas plant from Harvey Brown. It is the intention of the purchasers to get a competent man in Plattsville to look after the plant.

The Kinleith Paper Company, while boring for water, struck gas at a depth of 200 feet, and there appears to be a pretty good quantity of it. This is the first time gas has been struck in or near St. Catharines, and it is likely now, that others will immediately start boring.

The Monitor Mfg. Co. have completed a contract with the Victoria hospital, Fredericktom, for the instalation of a fifty-light acetylene generator. The company have also installed acetylene gas stoves in the various corridors thereby enabling the attendants to more quickly provide the foods needed.

The purification of gas building at the Montreal gas works was wrecked as the result of an explosion some few days ago. The loss is estimated at $3,000. The fire will not affect the lighting and heating plants of the city as the purifying pipes, which the gas passes through, are steel. When examined after the flames had been extinguished they were all intact.

The Department of Mines, Ottawa, will conduct this year a number of experiments in connection with gas producer engines. A model plant is being built in Ottawa on an acre of ground in the southern part of the city and the machinery is now en route from Europe. Reports of the experiment will be issued from time to time in hulletin form. Dr. Haanal, of the Department of Mines, investigated the recent advances in gas producer engines in Europe and experiments will be conducted in Ottawa along the line of recent developments. He will also experiment with peat as a fuel in this plant.

## Trade Notes.

The Crocker-Wheeler Co., Ampere, N.J., have received orders for two 400 k.w., 575 volt engine-driven railway generators for Edmonton.

Russel & Gifford, Canadian selling agents for Bundy traps, have removed their offices from 26 Lemoine Street, Montreal, to 504 Power building.

The Hill Bridge Building Co., Mitchell, have secured the contract from the Simcoe county council for 330 feet steel bridge over Nottawasaga river, to replace the wooden structure.

The Smart-Turner Machine Co., 191 Barton Street East, Hamilton, report the following recent orders: Duplex pumps from the Doty Engine Works, Goderich; Intercolonial Railway, River du Loup, P.Q.; Collingwood Shipbuilding Co., Collingwood; Rainy River Lumber Co., Port Arthur; E. Long Mfg. Co., Orillia; Georgian Bay Stock Mills, Midland; McLaren's, Hamilton; Helena Costume Co., London; Centrifugal pumps from Corporation of Medicine Hat; simplex vacuum pump, from Robt. Watson Co., Toronto; rotary feed pump and receiver for Technical School, Hamilton; jet condenser and duplex pump from Selby & Youlden, Kingston; rotary pump from Domestic Specialty Co., Hamilton, and an order for oil pump from McColl Bros., Toronto.

# Power Supply Markets

## Vancouver.

That business is not too bad in the West is shown by the success of a commission man who has reached here from Winnipeg, coming through on the main line of the C.P.R. He is a representative of manufacturers of leather belting and heavy machinery, and although only five weeks out has cleared $1,200 in commission in that time. A good sale, be told Canadian Machinery, was that of a big leatber belt 2,300 feet long. He will return via the Kootenay and Crow's Nest. Generally speaking, the agents of machinery houses have been doing very well in British Columbia.

Walter Thomas, who was formerly manager of the Vancouver Gas Works, and who recently invented a gas producer apparatus, has with associates bought out the works at Nanaimo. The plans of the company embrace plants at Ladysmith and Duncan, adjacent towns. The price was $30,000. The Nanaimo gas works were established 22 years ago by Nanaimo people, but later passed into the hands of Victoria capitalists.

Contracts for supplying the requisites for the waterworks in Vancouver have been let bv the city council as follows: Galvanized pipe, Crane & Company, Vancouver, $2,745,50; lead pipe, Robertson Godson Company, Vancouver, $1,720; brass goods, Chadwick Bros., Hamilton, Ont.

## Winnipeg.

Tenders will be received up to Thursday, April 15th, 1909, for the manufacture and delivery at Winnipeg of two testing transformers, viz., One 30 k.w. at 80,000 volts, and one 200 k.w. at 200,000 volts, also for control equipment therefor. Copies of the instructions to bidders, specifications and forms of tender may be obtained at the power engineer's office, Carnegie Library building, Winnipeg, Man. These specifications may also be seen at the office of Smith, Kerry & Chace, Confederation Life building, Toronto, Ont., or M. Peterson, secretary, office of the Board of Contral, Winnipeg, Man.

The prospect for power supplies fn the west is very satisfactory, there befng several large power plants contemplated.

LUBRICATING OILS—600 W. cylinders, 80c; Maple Leaf cylinder, $1 per gal.; 700 A cylinder, 75c; Sterling cylinder, 55c; 600 A cylinder, 50c; Capital cylinder, 59c and 54c; Solar red engine, 32c; Atlantic red engine, 29c; heavy castor, 27c; medium castor, 26c; Ruddy harvester, 28c; standard gas engine oil, 36c; Renown engine oil, 38c.

GASOLENE—Engine gasolene, gal., 22½c; f.o.b. Winnipeg, cases, $2.50.

## Toronto.

Indicatfons are that a steady trade fs being carried on in power lfnes. One Canadian company sold a large number of air compressors to Cobalt mine companies. The same company has been making several other important instalations.

The Hydro-Electric Commfssion has let contracts for twelve distributing and transformer stations. This calls for the expenditure of $750,000. The contractor is drawing material to convenfent points and the construction of the power scheme will be carried on with all speed.

BOILER TUBES—Prices are steady with a fair demand. The following prices are quoted per 100 feet: 2-in. $8.50 to $8.75; 2½-in., $10.50 to $10.75; 3-fn., $12.50; 3½-in., $15, and 4-fn., $18 to $19.

LEAD WOOL—$10.50 per 100 lbs., $200 per ton.

FIRE BRICKS—A good demand. English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000.

OILS—Prices are stationary with a good demand.

## Montreal.

OILS—The situation in this commodity presents the same appearance at this time as it did last month. There fs no change in the prices and the volume of business being done by dealers is steady.

The current prices (March 6th) are as follows: Cylinder oils, (imp. gal.) 60c to 80c; engine oils, 30c to 60c; machine and dynamo oils, 30c to 45c; shafting oils, 25c to 40c; lubricating greases, (per lb.) 8c to 12c.

BOILER TUBES—The condition of the steel market in the United States as regards the indecision in prices and the erratic movement of same is havfng the effect of making Canadian buyers look for lower prices. At this time last montb tbe tendency was to advance while now ft is the other way. Tbe prices on import goods are invariably lower than those on stock which remain the same.

The market on tubes, steel plates and the like, is at best, unwieldly, in this way, tbat stock prices are more or less steady quantities and not so susceptible to small cbanges or fluctuations as are the prices on tin, copper, brass, etc. Prices are as follows: 2-in. tubes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in, $15 to $15.75; 4-in., $18.50 to $19.50.

BOILER ACCESSORIES—A rather interesting cause for stimulation in this lines has developed in this district, more especially in the Maritime Provinces. Tbe long-continued drought and scarcity of water last year was so severe that many large plants had to shut down from time to time to allow water to accumulate. This scarcity of water for steam purposes has forced upon the attention of owners the question of effecting economies by saving condensation in every possible instance. This has led to inquiries for steam-saving specialties and, added to the fact that no more buying than absolutely necessary has taken place during tbe last eighteen or twenty months, has led to the purchasing of appliances such as steam and oil separators, steam traps, feed water regulating devices, etc., in increasing quantities. Municipal water services are putting on water meters to induce people to save as much water as possible—another reason for the attention directed towards steam saving devices.

## CATALOGUES.

STEAM PUMPS—Catalogue No. 76 from Dean Bros.' Steam Pump Works, Indianapolis, Ind., describing their boiler-feed, pressure, mine pumps, electrically and steam driven, and condensers.

SIGHT FEED OIL PUMP—Bulletin 209 from Sight Feed Oil Pump Co., Milwaukee, Wis., describing the Model M. Richardson automatic sight feed oil pump.

ELECTRICAL PRODUCTIONS—1909 catalogue from C. A. Vandervell, Warpley Way, Acton Vale, London W., England, giving particulars and prices of various C.A.V. specialties, comprising accumulators, ignition coils, magnetos, sparking plugs, switchboards, etc.

GAS ENGINES—Illustrated catalogue from Dubois Iron Works, Dubois, Pa., describing fully their single cylinder, tandem and twin tandem engines, arranged to operate on natural, illuminating and producer gas.

AIR PUMP AND JET CONDENSER—Dean Brothers' Steam Pump Works, Indianapolis, Ind. Circular. Shows a vertical air pump and jet condenser on which all the valves are accessible without disturbing any part of the pump. The piston rod is water sealed and the stroke is adjustable.

AIR COMPRESSORS—Catalogue No. 100 from Thos. H. Dallett Co., Philadelphia, describing their line of belt and steam driven air compressors.

VALVES—Catalogue from Alexander Gibb, 13 St. John Street, Montreal, Canadian agent for the Caskey Valve Co., manufacturers of valves in brass, steel and iron for hydraulic, air and steam uses. Thev are for all pressures up to 10,000 lbs. per square fnch.

STEAM SPECIALTIES—Illustrated catalogue from Ideal Steam Separator and Supply Co., Toronto, describes the McDaniel Improved Steam Trap, Watson steam pump governor and W. & McD. syphon pump. Other steam specialties included in the catalogue are copper floats, exhaust heads, relief valves, reducing valves, syphons, etc.

## BOOK REVIEWS.

ELECTRIC MOTORS—By Norman G. Meade, published by McGraw Publishing Co., 239 West 39th Street, New York; 155 pages, illustrated. Price, $1.

Electric Motors covers their instalation, control, operation and maintenance. Instructions are given in a practical manner. Mathematics have been practically eliminated and illustrations are used profusely to convey the meaning fntended. The suggestions made are based on personal experience and standard practice of electrical companies. In addition to subjects mentioned, a chapter is devoted to repairs and one to tables and formulas.

HANDBOOK OF SMALL TOOLS—By Erik Oberg; published by John Wiley & Sons, New York; 516 pages, 5x8 inches, 282 illustrations. Price, $3.

The book comprises threading tools, taps, dies, cutters, drills and reamers, together with a complete treatise on screw-thread systems. The subjects give the standard manufacturing practice of pitch lead, diameter, angle, rake, clearance, number of teeth, shape of flutes, sizes of squares, dimensions of shanks, taper per foot, etc., with 134 tables of valuable data, some of which has never been published previously. This collection of data includes chapters on screw-thread systems, methods and principles of thread-cutting and measuring threads, threading tools, taps for various work, threading dies, milling cutters, reamers and drills.

ALTERNATING CURRENT MACHINES—(Seventh edition) by Samuel Sheldon, Hobart Mason and Eric Hausmann; published by D. Van Nostrand Co., 23 Murray Street, New York; 343 pages, 5x7½ inches, Price, $2.50.

This book is intended primarily as a textbook for technical educational institutions and for those electrical, civil, mechanical and hydraulic engineers who wish to make a study of alternating currents and who have acquired some proficiency in mathematics. The first four chapters are to aid in a thorough understanding of alternating current and help in solving practical problems concerning the relations between power, electro-motive force, currents, etc. In the next four chapters, construction, principle of operation, etc., are taken up. In the ninth chapter, the subject of power transmission is treated. This book has reached its seventh edition, which is completely re-written.

TRANSACTIONS OF GAS ENGINEERS—Transactions for 1908; edited by Walter T. Dunn, secretary, 39 Victoria Street, Westminster, Eng.

Among the subjects treated in this volume are Co-Partnership, Continuous Carbonization in Vertical Retorts, Combustion and Thermal Decomposition of Hydro-carbons, etc. The volume contains 390 pages and all the papers are well illustrated.

## A TIMELY SUGGESTION.

Dear Sirs,—We have been subscribers to The Power House but a short time, but wish to say that we are very pleased with same. Every number is an improvement on the previous one. We think your "Course of Lessons for the Instruction of Stationary Engineers" a particularly valuable feature. Would a suggestion on same be out of place? Would it not make the course more valuable if with each lesson a few questions on the last lesson were printed, so that the student might test his knowledge of same? This would cause those taking advantage of the course to study same more carefully with the result that nothing important would be missed. It is safe to say that any answer that could be correctly given a month after studying the subject, would be firmly fixed fn the student's mind.

Hoping you may give this matter your consideration, and thanking you fn anticipation, we remain,

AITKEN & SON.

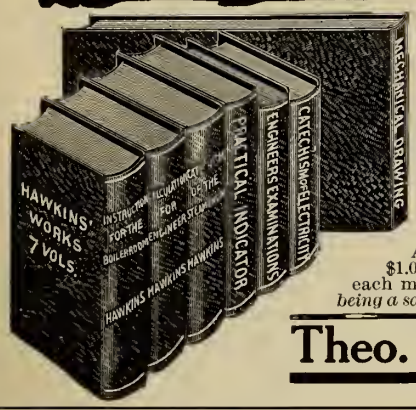
## HOW THE GAS ENGINE WORKS.

Nothing could be simpler than the working of a gas engine. "You see, when the piston comes up and compresses a lump of gas a spark jumps in and touches it off and the engine gives a poke, which turns the crank shaft around. Then the piston comes back and chases out the burned gas and takes in a fresh charge as it goes back; then it comes up and the load gets a spark and the piston is blown back and the crank shaft gets another poke, just as before. Every time a spark is let in the engine gets a poke, and gives it to the crank shaft, you see. It's perfectly simple and simply perfect."—Life.

## GAS ENGINES SUPPLANTING DUTCH WIND MILLS.

The old-fashioned Dutch windmills are becoming unpopular in the Netherlands. They are principally used in Holland for the purpose of pumping the water out of the drains. This must be done

*Hawkins Works*




## On Easy Payments.

Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

**SPECIAL OFFER** Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month (*when complete set is purchased the price is $12, being a saving of One Dollar*). **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed. ..... (Firm Name)

Home Address .....


regularly in order to keep the fields and meadows dry, the greater part of the Netherlands lying below the level of the sea. Gas motors are now being introduced for this purpose.

### REVOLTING CONVERSATION AT THE PLAN.

"Watt-hour you doing there?" asked the boss.

"Eatin' currents," replied the apprentice, shamefacedly. "Anode you'd catch me at it."

"Wire you insulate this morning, anyway?" demanded the boss.

"Leyden bed."

"Wouldn't that jar you! Can't your relay-shunts get you up mornings?"

"Amperently not."

"Fuse going to do that every day you can take your hat and go ohm," replied the boss, and the circuit was broken right there.—Ex.

Great confusion exists in a misuse of the word "ton." The unqualified term may mean the short ton of 2,000 pounds the long ton, gross ton or English ton of 2,240 pounds, the gross ore ton of 2,688 pounds, the miner's ton of 2,500 to 3,000 pounds, the displacement ton of 35 cubic feet, the timber ton of 42 cubic feet, the shipping ton of 40 cubic feet, and a register ton of 100 cubic feet more or less.

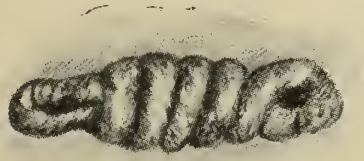
**Persons addressing advertisers will kindly mention having seen their advertisement in this paper.**


**JOHN GARDE & CO.**

142 Victoria Street TORONTO, ONT.

"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



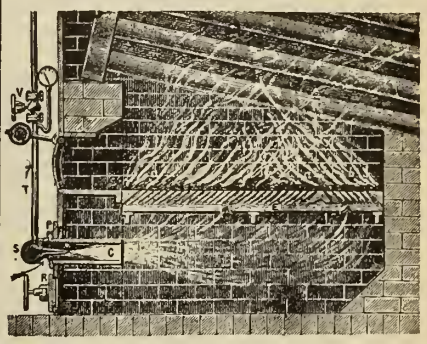
A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING

**LEAD WOOL**

"SHREDDED LEAD."

MADE IN ENGLAND



**Saves Money! Cheap Power!**

**with Venetian Grates**

To burn cheap grades of Anthracite or any other cheap fuel under your boilers.

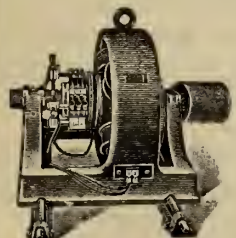
Saves 20% to 50% in your fuel bills.

*For Particulars Apply*

**J. de Clercy, C.E.**

**62 Ontario St., West**

**MONTREAL**

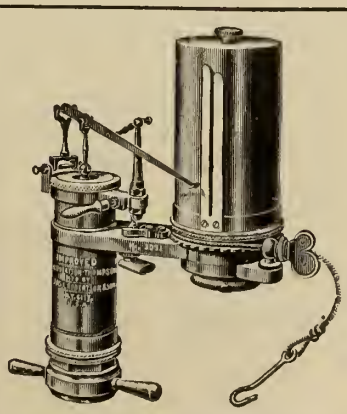


**DIRECT CURRENT MOTORS and DYNAMOS**

***FOR ALL PURPOSES***

**TORONTO & HAMILTON ELECTRIC CO.**

99-103 McNab Street, - - HAMILTON, ONT.



**Jas. L. Robertson & Sons**

38 Warren St., New York

**Get in Touch**

with your engine with a

**ROBERTSON-THOMPSON INDICATOR**

There's no easier—surer way to advance in position and salary than by making your engine run perfectly at lowest possible cost. Price moderate. Terms easy. The Willis Planimeter is a fine instrument.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

### Air Chambers.
Hercules Float Works, Springfield, Mass.

### Babbitt Metal.
Canada Metal Co., Toronto.

### Belt Tighteners.
Waterous Engine Works Co., Brantford.

### Belting, Leather.
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

### Boiler Feed Regulators.
Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boiler Mountings.
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Boilers.
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
Waterous Engine Works Co., Brantford.

### Boilers, Horizontal Tubular.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Marine.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Boilers, Vertical.
Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Castings, Brass.
Hercules Float Works, Springfield, Mass.

### Combustion Recorder.
Canadian Instrument and Testing Co., Montreal.

### Condensers.
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

### Consulting Engineers.
Bain & Mitchell, Montreal
De Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Sbanly, Montreal.

### Coppersmiths.
Hercules Float Works, Springfield, Mass.

### Crank Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Cross Head Pins.
Sight Feed Oil Pump Co., Milwaukee, Wis.

### Damper Regulators.
Darling Bros., Montreal
Peiler & MacKenzie, Montreal

### Dynamos.
Electrical Maintenance & Repair Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton.

### Electric Power Instalations.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Electrical Repairs.
Electrical Maintenance & Repair Co., Toronto.

### Elevating Machinery.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Engines, Automatic.
H. W. Petrie, Toronto.

### Engines, Corliss.
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

### Engines, Gas and Gasoline.
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
J. DeClercy, C.E., Montreal.

### Engines, High Speed, Steam.
Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

### Engines, Medium and Low Speed.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Saw Mill.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Engines, Simple and Compound.
Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

### Engines, Vertical.
H. W. Petric, Toronto.

### Exhaust Heads.
Darling Bros., Montreal
Standard Engineering Co., Toronto.

### Feed Water Analyser.
Canadian Instrument and Testing Co., Montreal.

### Feed Water Heaters
Darling Bros., Montreal
Brownell Co., Dayton, Ohio
Goulds Pump Co., Montreal.
Peiler & MacKenzie, Montreal

### Flanges
Dart Union Co., Toronto

### Floats, Seamless, Copper.
Hercules Float Works, Springfield, Mass

### Gas Producer Plants.
Bain & Mitchell, Montreal
Gas & Electric Power Co., Toronto.

### Gauges, Pressure, Vacuum and Recording.
Peiler & MacKenzie, Montreal

### Generators.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Grates.
Canadian Steam Boiler Equipment Co. Toronto
J. DeClercy, Montreal

### Gravity Closing Ventilators.
Standard Engineering Co., Toronto.

### Grease Cups.
Peterboro Lubricator Mfg. Co., Peterboro

### Hangers.
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Heaters.
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

### Indicators, Steam Engine.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Injectors.
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

### Lead Wool.
John Garde & Co., Toronto.

### Lubricators, Force Feed.
Darling Bros., Montreal
Sight Feed Oil Pump Co., Milwaukee, Wis

### Mechanical Stokers.
Jones Underfeed Stoker Co., Montreal.

### Meters, Water and Electric.
Peiler & MacKenzie, Montreal

### Mill Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Motors.
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.
Toronto & Hamilton Electric Co., Hamilton.

### Oilers, Gang.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Oil Filters
Darling Bros., Montreal

### Panels, Electric
Hill Electric Switch Co., Montreal

### Pipe Threading Tools.
Borden-Canadian Co., Toronto.

### Planimeters.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford.

### Power Transmission Machinery.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Shorbrooke, Que.
Waterous Engine Works Co., Brantford.

### Pump Governors.
Darling Bros, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pumps, Oil.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.
Goldie & McCulloch Co., Galt.

### Safety valves.
Peiler & MacKenzie, Montreal

### Shafting.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Sight Feed Oil Pumps.
Sight Feed Oil Pump Co., Milwaukee, Wis

### Special Machinery.
Electrical Maintenance and Repair Co., Toronto.

### Steam and Oil Separators.
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Steam Pumps.
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

### Steam Specialties.
Darling Bros., Montreal
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.
Darling Bros., Montreal
Peiler & MacKenzie, Montreal

### Stocks and Dies.
Borden-Canadian Co., Toronto.

### Switches, Electric
Hill Electric Switch Co., Montreal

### Switchboards, Light and Power.
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co , Montreal

### Tanks, Blow-off
Darling Bros., Montreal

### Tanks, Oil.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Sight Feed Oil Pump Co., Milwaukee, Wis
Waterous Engine Works Co., Brantford

### Tests and Inspections.
Bain & Mitchell, Montreal

### Transmission Machinery.
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Turbine Water Wheels.
Jenckes Machine Co., Sherbrooke, Que.
Jas. Morrison Brass Mfg. Co., Toronto.
J. C. Wilson & Co., Glenora, Ont.

### Unions
Dart Union Co., Toronto

### Vacuum Regulating Valves.
Darling Bros., Montreal
Peiler & MacKenzie, Montreal

### Valve Reseating Machines
Darling Bros., Montreal

### Vaults & Vault Doors.
Goldie & McCulloch Co., Galt.

### Watt Meters.
Gas & Electric Power Co., Toronto.

# One Moment Please

## Are You Obtaining the best Results From Your Boiler?

¶ You can get 100 cents worth of steam for every dollar's worth of fuel, providing your boiler is clean and in good condition.

¶ **"SKALEOFF"** will positively remove and prevent scale and will preserve the boiler and packing.

¶ **"SKALEOFF"** can be kept in the boiler as long as you may require to keep the boiler closed. There is no need of changing the water except when cleaning out the boilers.

¶ **"SKALEOFF"** does not contain any strong corroding ingredients, such as acid-salts, caustics, slacked lime, soda ash, etc.

¶ **"SKALEOFF"** positively will not eat packing or scratch the various engine or pump rods, it will not ruin valves or joints, it will not cause a leaky boiler either at a seam, joint or rivet.

¶ We will be pleased to furnish, free of charge, enough **"SKALEOFF"** to make a thorough test.

¶ There is satisfaction in every barrel and our guarantee goes with every barrel you get.

¶ *Send for particulars and have a free test made in your own boilers under your own conditions. Don't take our "say so" let us SHOW you.*

## The "SKALEOFF" CO.

**65 Shannon Street**

**Montreal**

# THE BIG THREE in ELECTRICITY

**Franklin Discovered It—Edison Developed It—The Cyclopedia Applies It**

CYCLOPEDIA *of*

# APPLIED ELECTRICITY

**is a practical guide for every man who wants information regarding electrical appliances. This work presents in compact, practical form and in simple, non-technical language, the results of the best work of the best men in the electrical profession; it lays the foundation of electrical progress for years to come.**

**THE YOUNG MAN** who has not yet chosen his life's work, will find it a valuable guide to one of the greatest money making professions of the present and future age. The development of this vast science has just begun. There is plenty of room at the top for inventive genius and new discoveries that will bring fame and fortune.

**THE ELECTRICAL WORKER,** whether "trouble shooter" or expert, will find this Cyclopedia especially valuable as an index to what he knows and a ready reference to what he has forgotten.

**THE BUSINESS MAN AND HOUSE OWNER** can gain from it a knowledge of electricity that will save him many a dollar.

This Cyclopedia covers the whole electrical field more completely than any other group of volumes. It comprises 2,896 pages of up-to-date, authoritative information; it treats of 23 general subjects; its detailed index includes over 4,000 different topics. It contains hundreds of special photographs, diagrams, sections, etc., besides condensed tables and formulas, containing information that it would require years of time and a fortune to collect. The pages are 7x10 inches in size, printed on special paper, in large, clear type, carefully bound in half morocco.

***FREE FOR EXAMINATION***—Fill in and mail the coupon. We will send you a set of these practical books for five days' FREE examination. Examine the books carefully. If satisfactory, send us $2.00 within five days and $2.00 per month until you have paid **the special $18.60 price.** The regular list price is $36.00. If you don't keep the books, advise us and we will send for them. **Remember!** You can examine the books without expense or obligation—we pay all express charges.

### IMPORTANT SUBJECTS COVERED

**Theory, Calculation, Design and Construction of Generators and Motors; Electric Wiring; Electric Telegraph; Wireless Telegraphy; Telautograph; Types of Dynamos and Motors; Elevators; Direct Current Motors; Direct-Driven Machine Shop Tools; Electric Lighting; Electric Railways; Alternating Current Motors, etc.; Single Phase Electric Railway; Management of Dynamos and Motors; Power Stations; Central Station Engineering; Storage Batteries; Power Transmission; Alternating Current Machinery; Telephony; Automatic Telephone; Wireless Telephony, Telegraphone, etc.**

### FREE! IF YOU ORDER PROMPTLY

With all orders received before March 1st, we will include for one year, as a monthly supplement, the

TECHNICAL WORLD MAGAZINE

An ideal American family monthly - regular price $1.50. Clean, instructive, helpful and true—with the whole round world as its field. Present day, scientific facts and inventions are treated in a manner so clear and comprehensive that any one can understand and every one can learn.

"WHO OWNS THE EARTH?" The strongest and most instructive serial ever published began in the January issue. We will include both the January and February numbers.

**AMERICAN SCHOOL OF CORRESPONDENCE**

**CHICAGO, U.S.A.**

### FREE OFFER COUPON

**American School of Correspondence:**

Please send Cyclopedia of Applied Electricity for FREE examination: also T.W. for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60, otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

POWER HOUSE—2—09

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock ..... inside front cover
American School of Correspondence ..... 41
Audel & Co., Theo ..... 39

**B**

Beaubien, De Gaspe ..... 48
Brownell Co ..... 1

**C**

Canada Metal Co ..... 45
Canadian Association of Stationary Engineers ..... 47
Canadian Instrument and Testing Co ..... 43
Canadian Rand Co ..... 47
Canadian Steam Boiler Equipment Co ..... 7

**D**

Darling Bros ..... 5
Dart Union Co ..... 7
Death & Watson ..... 48
De Clercy, Jules, C.E ..... 39, 48

**E**

Electrical Maintenance & Repair Co ..... inside back cover

**F**

Farmer, John T ..... 48
Featherstonhaugh ..... 48
Francis, Walter J ..... 48

**G**

Garde, John, & Co ..... 39
Gas & Electric Power Co ..... 2
Goldie & McCulloch Co ..... 8
Goodhue, J. L., & Co ..... 5
Goold, Shapley & Muir ..... 3

**H**

Hercules Float Works ..... 48
Hill Electric Switch Co ..... 48

**J**

Jenckes Machine Co ..... 3
Jones Underfeed Stoker Co ..... 1

**K**

Kerr Engine Co ..... 47
Kilmer, Pullen & Burnham ..... inside back cover

**Mc**

McLaren, D. K., Ltd ..... 4

**M**

Mitchell, C. H. & P. H ..... 48
Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

**P**

Packard Electric Co., Ltd ..... 42
Peiler & MacKenzie ..... 6
Penherthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 6

**R**

Rae, J. B ..... 48
Robb Engineering Co ..... 2
Robertson, Jas. L., & Sons ..... 39
Robertson, J. M ..... 48

**S**

Sadler & Haworth ..... 5
Sammett, M A ..... 48
Shanly, J. M ..... 48
Sight Feed Oil Pump Co ..... 3
Skaleoff Co ..... 41
Standard Engineering Co ..... 7

**T**

Technical Books ..... 48

**W**

Waterous Engine Works Co ..... 1


# Condensed Advertising

***RATES***

One insertion—25c. for 20 words; 1c. a word for each additional word.

Yearly rate—$2.50 for 20 words or less; 10c. a word for each additional word.

## DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Machine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. The "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

## ELECTRIC LIGHTING.

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

## MISCELLANEOUS.

NOTICE—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator, and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts for the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ontario.

THE RELIABLE LIGHT will light your store 100% better than gas, electricity or acetylene. 600 candle power light costs 1 cent per hour to operate. Thousands in use. A safe, reliable, pure white light of intense brilliancy. Write for booklet M. The Rice-Knight Mfg. Co., Limited, 40 Lombard Street, Toronto.

# Incandescent Lamps

*Packard*

**The Old Reliable**

**Used Everywhere**

*All Standard Candle Powers and Voltages.*

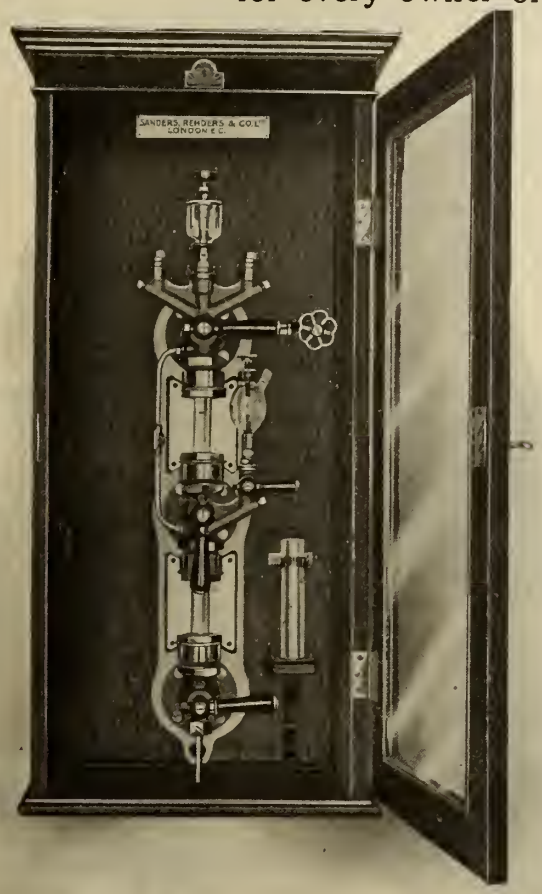
# The Packard Electric Co., Limited

**Head Office and Works: St. Catharines, Ont.**

**Branch Offices:**
**Montreal**
**Winnipeg**

# Instruments that positively SAVE MONEY

for every owner of a Steam Power Plant.



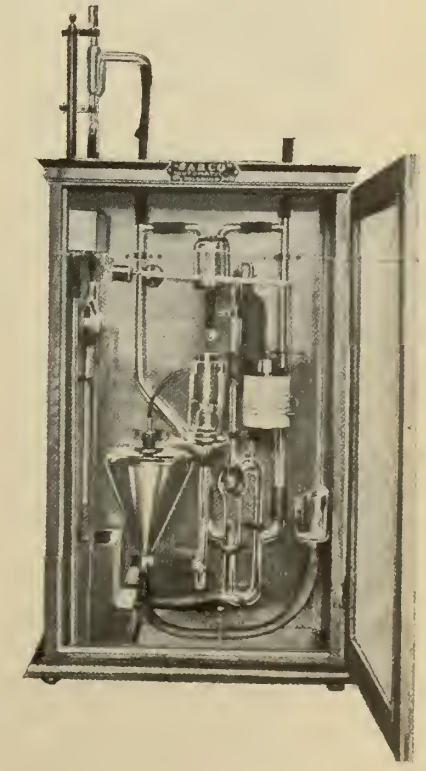

## Boiler Scale Prevention

is one of the toughest problems you have to face as the owner of a steam boiler. It is well known that Soda is the best preventative of Boiler Scale; the difficulty has been to know the right quantity to apply to the feed water. Thus more or less elaborate water softening plants often fail to prevent scale formation. But the problem has now been satisfactorily and inexpensively solved by the invention of the

# "SARCO"

## Feed Water Analyser

a small and simple instrument which analyses your feed water from day to day, infallibly indicating the exact amount of soda necessary to absolutely prevent the formation of scale in your boilers. We positively guarantee SARCO FEED WATER ANALYSER to give an absolutely correct analysis of any feed water to which it is applied.




## You Lose Money on Incomplete Fuel Combustion;

and if you had an instrument that would automatically tell you every hour just exactly how near perfectly your fuel was burning, you would save a lot of money; because "fore-warned is fore-armed." It would enable you to make provision to get a hundred cent's worth of combustion for every dollar's worth of fuel shovelled into your boiler furnace. There is such an instrument!—the

# "SARCO" Combustion Recorder

It automatically analyses the exit gases created by fuel combustion, and indicates upon a chart, in plain view all the time, the exact percentage of carbon dioxide which that gas contains. 20% Carbon Dioxide (C O 2) indicates practically complete combustion. Consequently the farther your furnace is from effecting complete combustion the more it is up to you to STOP THE WASTE.

Full particulars and prices sent immediately upon request.

# Canadian Instrument and Testing Co.

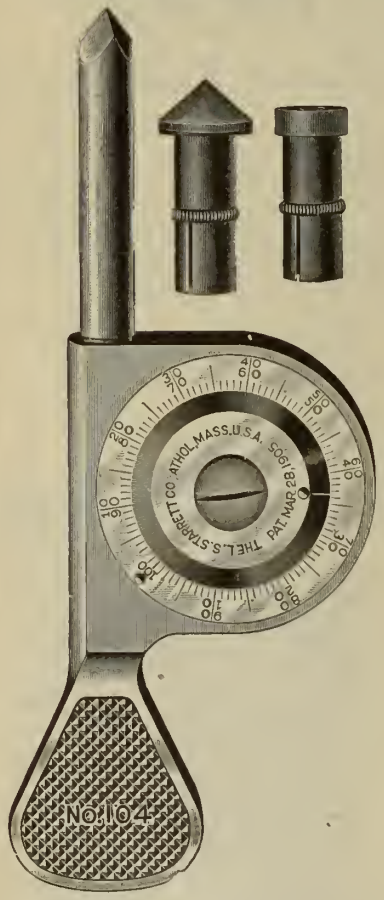
Montreal - - - Canada

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**



**STARRETT REGISTERING SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**

"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

Start in TO-DAY to earn one of these Handy Tools.

**THE POWER HOUSE, 10 Front Street East, Toronto**

## Not "Just as Good"

but—

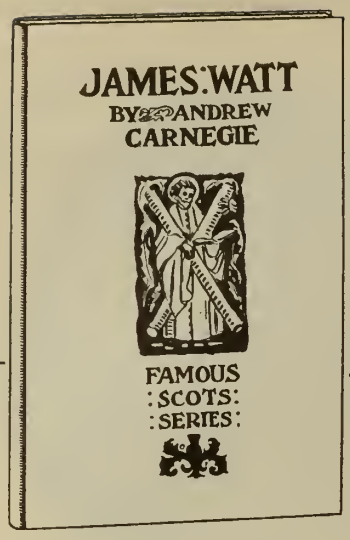
## A Great Deal Better

# HARRIS
# HEAVY PRESSURE BEARING METAL

Casts a Perfect Bearing. Positively Eliminates Friction to a Minimum. Will not Break or Crack in Bearing. For Quality and Durability There is No Equal. For Sale Everywhere.

*Manufactured by*

## The Canada Metal Company Limited
**Toronto**




# Free to Subscribers

**A copy of this book for one new, paid-up subscription.**

This book records the life and achievements of James Watt, inventor of the Steam Engine.

It makes the best of reading for the modern engineer, telling of the difficulties encountered and overcome by the father of steam engineering.

Have you read it?

Here is your chance to get a copy **free** although you couldn't buy this book under a dollar.

Among your engineering acquaintances there is a man who ought to get The Power House every month—but doesn't.

You know The Power House—how instructive and valuable it is to the practical engineer.

Tell your acquaintance about it. Take his subscription for a year. You will be doing him a good turn without undergoing much effort.

Send us the dollar and his name and address and we will send you by return mail, **absolutely free,** a copy of "James Watt" by Andrew Carnegie, handsomely printed, bound in cloth boards, costing a full dollar to obtain any other way.

DO IT NOW—THE BOOK IS YOURS.

**THE POWER HOUSE** 10 Front Street East, TORONTO

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization ?

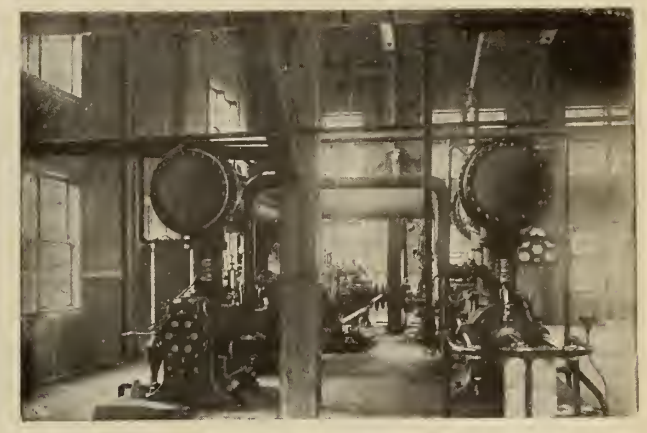
Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

# RAND AIR COMPRESSORS



Whatever your requirements are we can now make quick delivery, mostly from stock.

If interested in Compressed Air have our representative call

**Canadian RAND Co., Limited**
MONTREAL, CANADA
TORONTO: 1105 TRADERS' BANK BUILDING

# *KERR GATE VALVES*

***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

***The Kerr Engine Co., Limited***
***Valve Manufacturers***
***Walkerville, - Ontario***

# PROFESSIONAL DIRECTORY

**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**JULES DE CLERCY, M.E.**
GAS ENGINEER
Expert knowledge of all classes of Engines and Producer Plants. If you are thinking of installing a Gas Engine or Producer Plant write me. If your plant is not working satisfactorily I can help you.
62 Ontario St. West, - MONTREAL, QUE.

**M. A SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Estimates, Reports, Plans and Specifications. Supervision of Power. Lighting and Railway Installat
Liverpool London and Globe Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS' BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**CONSULTING AND SUPERVISING ENGINEERS**
You should have your card appear regularly on this page—you may miss important engagements by not being represented.

The Best Floats are
**HERCULES Seamless Copper FLOATS**

They won't rust or get water-logged. About the only way you can injure a Hercules Float is to do it deliberately.

Ask us for Catalog "C."
**Hercules Float Works**
P.O. Box 396. Springfield, Mass.

**Electric Switches**
whether you want one or fifty, it will pay you to get our price.
Prompt shipment from a large, well assorted stock.
The best equipped factory in Canada devoted entirely to manufacture of switches and switchboards at your service.
**THE HILL ELECTRIC MFG. CO.**
1560 St. Lawrence Boulevard, - Montreal

**WATER POWER**
By J. P. Frizell
An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.
658 PAGES 251 ILLUSTRATIONS
**Price $5.00, postpaid**
**MACLEAN PUBLISHING COMPANY**
TECHNICAL BOOK DEPARTMENT
10 Front St East - - Toronto

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419

# The General Electric Co. of Sweden

400-H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

If you require anything in the line of

**Steam or Water Goods**

we can furnish it.

We make the largest variety in

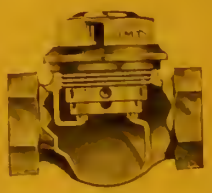
# Engineers' Supplies

## and Steam Specialties

Quality and utility should be the first consideration in the purchase of Steam Goods.

Our goods have the backing of over twenty-five years' service to satisfied customers.

J.M.T. Cushion Check Valve




J.M.T. Swing Check Valve

**J.M.T. VALVES**

Built for Durability

J.M.T. VALVES are made in all the standard patterns of Globe, Angle, Check and Gate Valves—procurable of all dealers, or direct.

THE JAMES MORRISON BRASS MFG. CO. LIMITED

TORONTO ONT.

CIRCULATES IN EVERY PROVINCE OF CANADA.

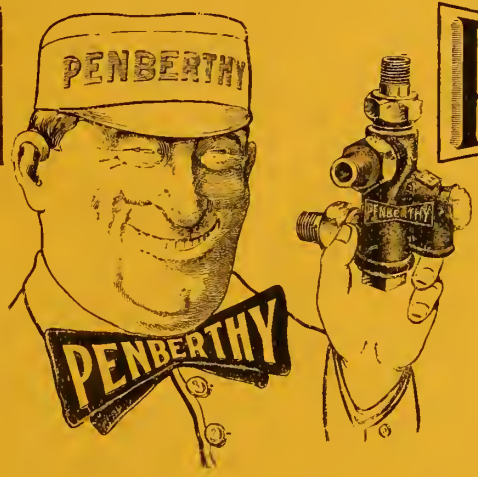
# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C.

Vol. II. Publication Office, Toronto - April, 1909 No. 4

TRADE PENBERTHY MARK.




TRADE PENBERTHY MARK.

AUTOMATIC SELF-DRAINING

## 550,000 Genuine Penberthy Injectors

Have been Sold in the past Twenty-Five Years with entire Satisfaction to all Purchasers

"SALUTE." Sight-Feed Flushing Oiler, fitted with snap lever. Feed of oil started or stopped without disturbing the regulation.

"SILEX." A Self-Feeding Grease Cup, made of the best red metal, screw in shank to regulate the feed. One of the best cups on the market, and a great favorite with engineers.

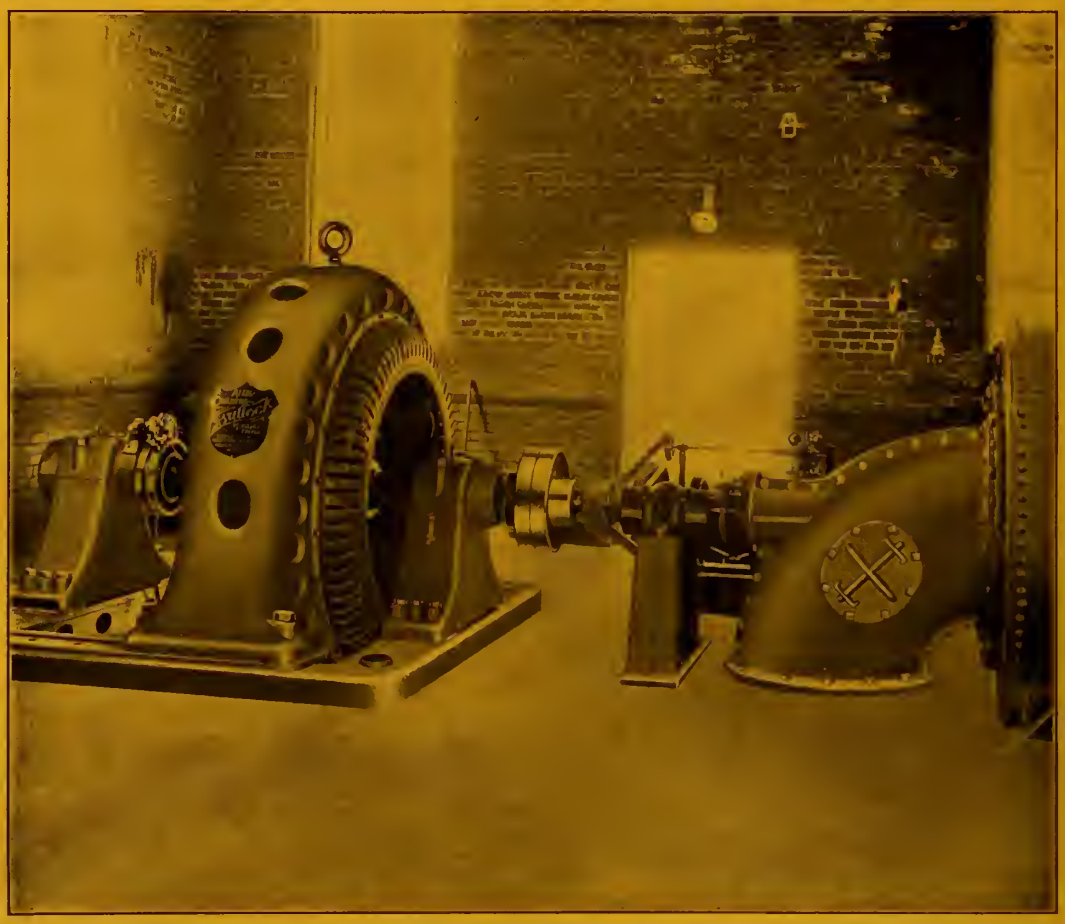
"SAFETY." An Oil Cup for the Crank Pin, that starts feeding when the engine is running and shuts off when the engine stops. Made strong and durable.

MANUFACTURED BY

PENBERTHY INJECTOR CO., Limited, WINDSOR, ONT.

# HYDRO-ELECTRIC PLANTS

OF ALL CAPACITIES



One of our 450 K. W. water wheel type alternating current generators, forming part of a small municipal power plant. The different apparatus is described in the following bulletins which will be sent on application.

Bulletin 303 Hydro-Electric Plants.
Bulletin 300 Lighting Transformers.
Bulletin 1047 Power Transformers.
Bulletin 1050 Water Wheel Type Alternators.
Bulletin 1612 Hydraulic Turbine Governors.

## ALLIS-CHALMERS-BULLOCK

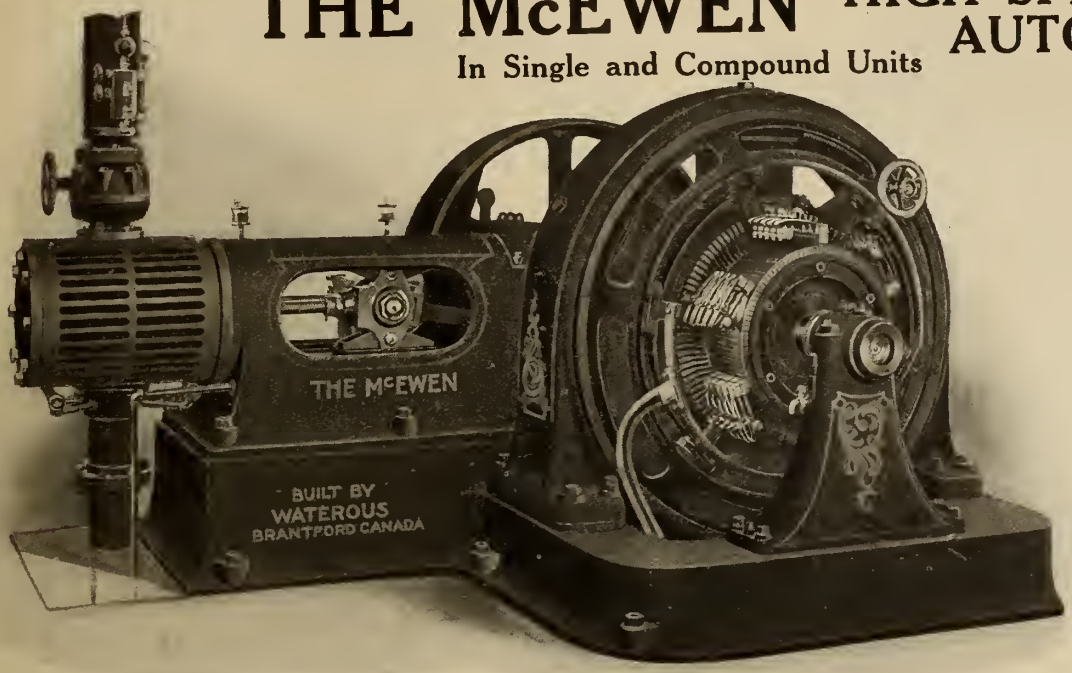
LIMITED

**Works : Montreal**

**Sales Offices : Montreal, Toronto, Winnipeg, Vancouver, Cobalt, Calgary**

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units




Specially Suited for Direct Connected Electrical Works.

Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

BRANTFORD, - ONTARIO

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

On Account of their Extremely Low Cost of Operation and the Small Amount of Attention Required

## Goulds Efficient Power Pumps

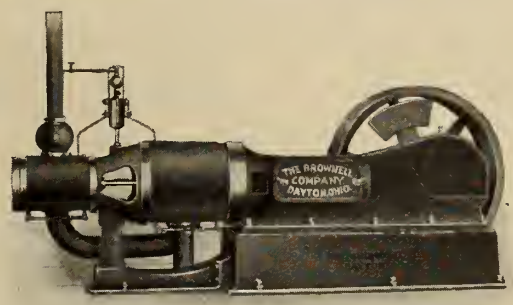
are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

## Goulds Pump Co.

Coristine Bldg., Montreal

Phone Main 1054

*Works - - - - - - Seneca Falls, N.Y.*




## The Brownell Company

Dayton, - Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

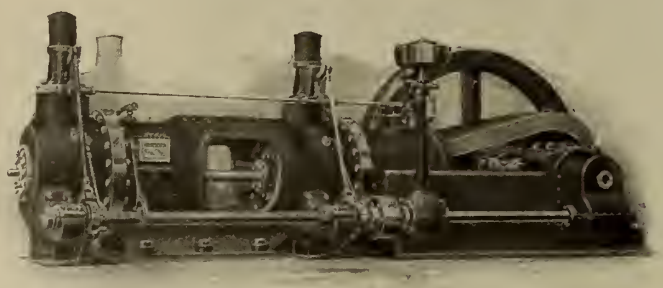
**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# Producer Gas

is not only every bit as reliable as steam, but is also far more economical than steam or any other form of power production if you use a

# Warren Gas Power Plant



Cut shows the Warren Tandem Type Machine. Sizes to 1000 h.p. Engines of this type operating within a day's travel of Toronto have established world's records in fuel economy.

WRITE FOR OUR ILLUSTRATED LITERATURE

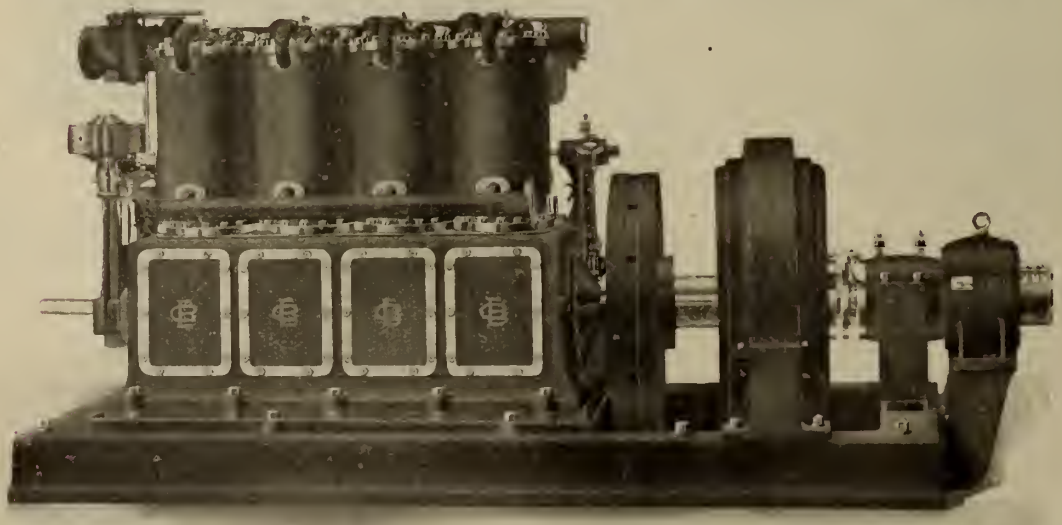
We don't expect you to take our word for it—we can show you the proof of actual results accomplished. Within four hours travel of Toronto there are more than 10,000 h.p. of Warren Engines giving entire satisfaction to their owners and carrying out our claims to the letter. Our selling plan amounts to a guarantee—you don't need to sign a cheque until you are convinced by demonstration.

## W. H. Oliver & Company

Exclusive Sales Agents for the Struthers-Wells Co., Warren, Pa.

M 509 McKinnon Building, - - TORONTO

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants Pressure Gas Plants



Engine direct connected to alternators, guaranteed to run in parallel successfully.

Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.

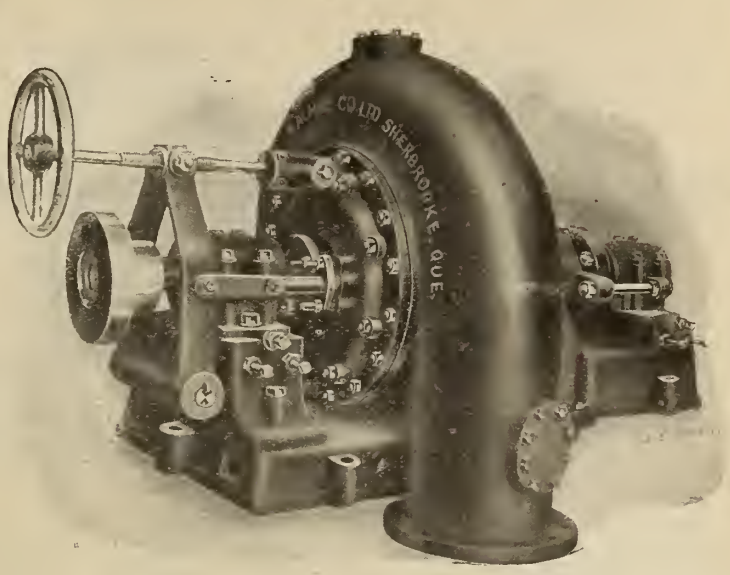
Stair Building, Bay Street - TORONTO

# Turbine Water Wheels

¶ From careful study and our large experience in water wheel building, we have evolved our New Improved Turbine.

¶ It is a good thing, and we want you to know all about it.

¶ A line to our nearest office will bring a catalogue and particulars.



## The Jenckes Machine Company, Limited

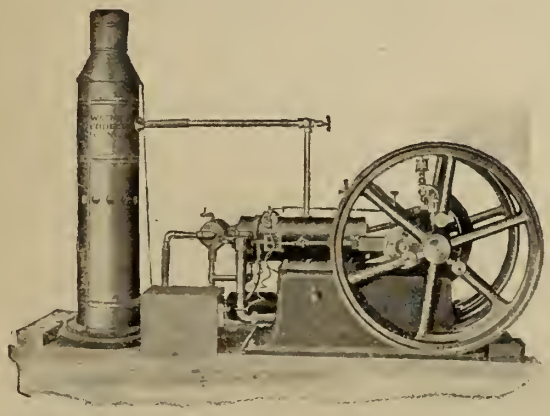
**Sherbrooke** **Montreal** **St. Catharines** **Cobalt** **Vancouver**

**Works :**

**Sherbrooke, Que. ; St. Catharines, Ont.**

# GAS and GASOLINE ENGINES

## 1½ to 25 H.P.

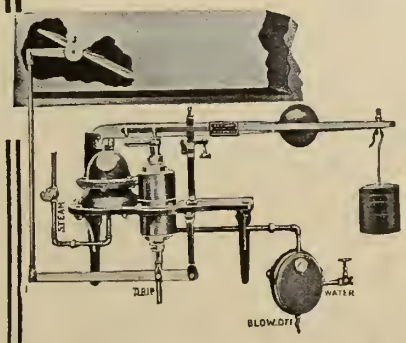


**If interested it will pay you to write for our Catalogue**

## Goold, Shapley & Muir Co.

Limited

**BRANTFORD - CANADA**




# Stillman-Carmichael Improved Damper Regulator

Can be attached to HIGH and LOW pressure steam boilers.

It will govern one or more boilers.

It will close or open the damper or dampers on a variation of one pound of steam.

The workmanship on this Regulator is of the very best, and all parts are made in duplicate.

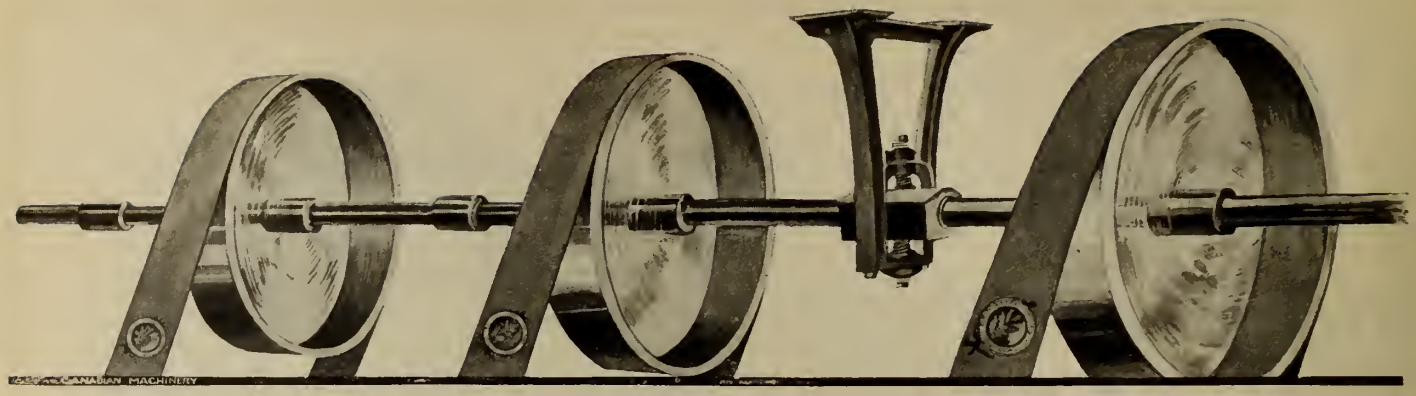
The saving effected in fuel by the installation of this Regulator will vary from 5 to 18 and the first cost of the regulator is very small.

*If interested write for Pamphlet "C"*

## DARLING BROTHERS, Limited

**Head Office and Works, 106 Queen St.**

**TORONTO** **MONTREAL** **WINNIPEG**



# RELIABILITY-ECONOMY

That's the ideal combination you are looking for when purchasing belting. And that's the combination secured by every purchaser of

## D.K.McLaren's GENUINE BRITISH OAK TANNED LEATHER BELTING

It is made from the centres of selected hides—absolutely no Shoulders, Necks or Bellies are used.

The Tanning Process is the real British Oak Tanned Process which is acknowledged to be the most efficient process known. Every inch of our belting is reliable, while our prices certainly are the lowest—quality considered.

**Our regular lines--Extra "C" and D. K. Balata—are the most reliable beltings for general purposes, and full stocks are carried at all our warehouses.**

*Write for complete price list*

## D. K. McLAREN, LIMITED

**MONTREAL**
309-311 Craig Street West

**TORONTO**
200 King Street West

**QUEBEC**
21 St. Peter Street

**ST. JOHN, N.B.**
64 Prince William Street

**WINNIPEG**
Fred. J. C. Cox & Co., Representatives

**VANCOUVER**
418 Abbott Street

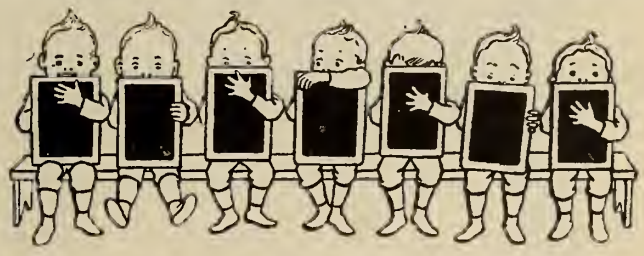
**Every Manufacturer Using a Steam Boiler Should Know**
that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)
IS THE
GUARANTEED BOILER CLEANER

Manufactured by
The CANADA CHEMICAL MANUFACTURING COMPANY, Limited
Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL

## Figure Out Your Belt Expenses
### For the Last Five Years



Weren't those breakdowns costly? Wouldn't you have avoided them if possible, and you had known how? You could have avoided them if your belt had been a Goodhue belt.

You were probably persuaded to put in a cheap belt—**there's** the rub, a **cheap** belt, a belt that saved considerable on first cost and gave satisfaction—at **first.** It wasn't long, however, before the poor quality and slipshod methods of manufacture began to show up in cracks, breakages, etc, and many delays occurred which would have been avoided if a **good** belt, **good all through,** (a Goodhue belt) had been used.

Our belts are made from selected hides, slow process tanned (**in our Tanneries**) and made up by experts in an up-to-date factory by methods that absolutely guarantee long life and satisfaction. Our three brands are

**"EXTRA" "STANDARD" "ACME-WATERPROOF"**

the latter being unsurpassed for use in wet places.

**Have you belting difficulties?**
**Let's talk them over.**

## J. L. Goodhue & Co. Danville, Que.

# OAK LEATHER BELTING

The prime factor in belt making is good hides.
Our own agents gather the hides used in our belts from all parts of the world.
We use only the best parts (the centers) of the trimmed hides.

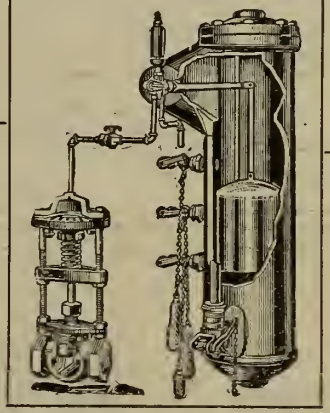
SADLER & HAWORTH
FACTORIES
MONTREAL. TORONTO
BRANCHES
ST JOHN. N.B.
WINNIPEG
BRANCHES
CALGARY
VANCOUVER

After choosing the hides it is important to have the very best tannage. We use the old-fashioned long method (taking five to six months), which is the only satisfactory way of tanning leather for belting. We fully guarantee our belting.

# MASON

Reducing Valves
Pump Pressure Regulators
Damper Regulators
Pump Speed Governors
Balanced Valves

It is not what you pay for an article, but what the article pays you in return for its cost, that determines its value.



(Genuine)

# ASHTON

Pop Safety Valves
Pressure Gauges
Vacuum Gauges
Recording Gauges
"Ideal" Alarm Gauges

## Berry Boiler

## Feed Control

THE SIMPLEST AND BEST REGULATOR

If your dealer cannot supply you, write to us for catalogues and full particulars.

WE ALSO SELL

## BUNDY STEAM TRAPS

THE BEST FOR ALL SERVICES.

## Peiler & MacKenzie,

52 ST. JAMES STREET
MONTREAL

# STEAM EQUIPMENT

### Automatic Engines

2 13"x23"x30" compound Wheelock.
1 refitted 14"x34" R. H. Wheelock.
1 refitted 13"x30" L. H. Corliss.
1 refitted 12"x30" R. H. Corliss.
1 refitted 12"x10" Westinghouse Jr.
1 refitted 10"x10" Leonard-Peerless
1 new 10"x15" No. 8 Jewel.
1 refitted 10"x24" L. H. Brown.
1 refitted 9½"&14½"x12" compound.
1 refitted 8"&13"x18" compound.
1 rebuilt 7"x10" Leonard-Ball.

### Horizontal Engines

1 refitted 16" x 24" L. H. rocking valve.
1 refitted 11¼" x 14" L. H. slide valve.
1 new 12"x15" C.C. slide valve.
1 refitted 12"x12" C.C. slide valve.
1 refitted 10½"x14" C.C. slide valve
1 refitted 10½" x 16" R. H. slide valve.
1 new 10"x15" C.C. slide valve.
1 rebuilt 11" x 11" C. C. rocking valve.
1 new 9"x12" L.H. slide valve.
1 refitted 9"x12" L.H. slide valve.
1 refitted 8¾"x9" R.H. slide valve.
1 refitted 8"x13" R.H. slide valve.
1 refitted 8" x 12" R. H. rocking valve.
1 refitted 7¾"x12" R.H. slide valve
1 refitted 7"x10" C.C. slide valve.
1 refitted 7"x12" L.H. slide valve.
1 refitted 7" x 12" C. C. rocking valve.
1 new 6"x9" C.C. slide valve.
1 refitted 6½x10" L.H. slide valve.
1 refitted 6"x10" R.H. slide valve.
1 refitted 6"x7½" C.C. slide valve.
1 refitted 6"x6" C.C. slide valve.
1 new 5"x6" C.C. slide valve.
1 rebuilt 5½"x6½" C.C. slide valve.
1 refitted 4"x5" C.C. slide valve.
1 refitted 2¾"x5" C.C. slide valve.
1 refitted 2½"x3" C.C. slide valve.

### Vertical Engines

1 refitted 16"x16" slide valve.
1 new 7½"x10" Dutton slide valve.
2 new 7½"x9" Dutton slide valve.
1 new 7½x8" Dutton slide valve.
1 refitted 7"x8" Troy slide valve.
1 refitted 6"x8" piston slide valve.
1 new 6"x7½" Dutton slide valve.
1 new 5"x7½" Dutton slide valve.
1 refitted 5½"x7" Dotv slide valve.
1 new 4"x5" Dutton slide valve.
1 new 4½"x5" Dutton slide valve.
1 refitted 4"x4" Bell slide valve.
2 new 3½"x5" Dutton slide valve.
1 refitted 3¾"x4" roeking valve.

### Vertical Boilers

1 refitted 48"x10'6" contains 152-2" tubes.
1 new 36"x96" contains 55-2" tubes.
1 new 36"x84" contains 55-2" tubes.
1 refitted 40"x65" contains 137-1½" tubes.
1 refitted 36"x78" contains 52-2½" tubes.
3 new 30"x72" contains 43-2" tubes.
1 new 30"x60" contains 43-2" tubes
1 refitted 30"x65" contains 44-2" tubes.
4 new 26"x60" contains 37-2" tubes.
1 new 24"x60" contains 31-2" tubes.
1 refitted 26"x48" contains 37-2" tubes.
1 refitted 24"x48" contains 19-2½" tubes.
1 refitted 24"x36" contains 61-1¾" tubes.
1 refitted 23"x44" contains 37-2" tubes.
1 refitted 22"x50" contains 22-2" tubes.
1 new 20"x43" contains 19-2" tubes
2 new 20"x36" contains 16-2" tubes.
1 refitted 19"x37" contains 14-2" tubes.
6 new 19"x44" contains 13-2" tubes
2 refitted 19"x44" contains 13-2" tubes.

### Horizontal Boilers

1 refitted 66"x14'7" contains 106-3" tubes.
1 refitted 60"x17'6" contains 54-4" tubes.
1 refitted 63"x14' contains 64-3½" tubes.
1 refitted 56"x14'4" contains 64-3" tubes.
1 nearly new 60"x12' contains 82-3" tubes.
1 refitted 60"x13'6" contains 72-3" tubes.
1 refitted 54"x14' contains 70-3" tubes.
1 refitted 50"x14' contains 64-3" tubes.
1 refitted 54"x12' contains 64-3" tubes.
1 refitted 56"x12' contains 60-3" tubes.
1 refitted 52"x11' contains 68-3" tubes.
1 refitted 48"x13'6" contains 44-3" tubes.
1 refitted 44"x13'2" contains 48-3" tubes.
1 refitted 48"x13'6" contains 42-3" tubes.
1 refitted 44"x11'6" contains 43-3" tubes.

### Horizontal Boilers
(Continued)

1 refitted 41"x10' contains 48-3" tubes.
1 refitted 40"x13'4" contains 36-3" tubes.
1 refitted 36"x11'6" contains 32-3" tubes.
1 refitted 38"x15' contains 34-3" tubes.
1 refitted 38"x13'2" contains 33-3" tubes.
1 refitted 38"x12' contains 26-3" tubes.
1 refitted 36"x11'9" contains 23-3" tubes.
1 refitted 38"x10'11' contains 28-3" tubes.
1 refitted 32"x11' contains 23-3" tubes.
1 refitted 30"x8' contains 16-3" tubes.
1 refitted 43"x49" contains 60-2½ tubes.
1 refitted 15"x36" contains 13-2" tubes.

### Fire Box Boilers

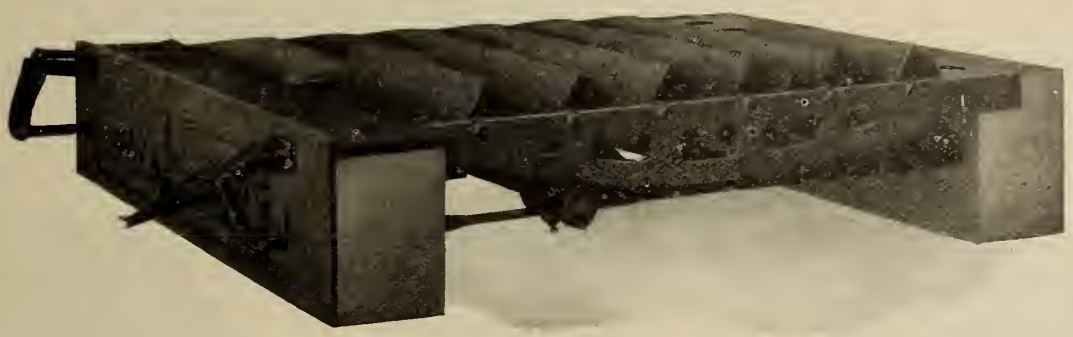
1 refitted 48"x20' contains 70-3" tubes.
1 refitted 44"x18" contains 48-3" tubes.
1 refitted 42"x16'8" contains 43-3" tubes.
1 new 39"x14'8" contains 36-3" tubes.
1 refitted 36"x12'11" contains 43 2½" tubes.

# H. W. PETRIE, Limited

TORONTO
MONTREAL
VANCOUVER

# The New Model "Diamond" Shaking and Dumping Grate Bar

No lost motion. No heavy clinkers. No jamming.



Easy of operation. A perfect dumping bar. A perfect shaking bar.

***Will Last a Life Time***

Constructed so that they can be placed under any type of Boiler within a short time. No extensive alterations to brick work.

Will burn any grade of fuel with a minimum of waste. The grate has a greater air space than any other, therefore better combustion.

## *The "Diamond" Grate has no Equal as a Fuel and Labor Saver*

We make a specially heavy Diamond Bar for Steamboats and Malleable Annealing Ovens.

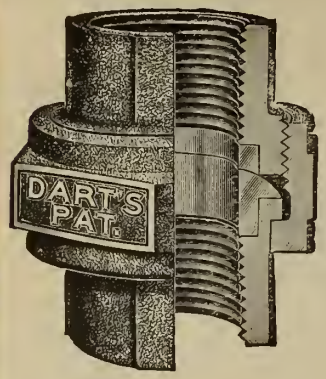
*A post card or personal enquiry will bring a prompt reply.*

**We make a specialty of Boiler Setting and repairs to Boilers**

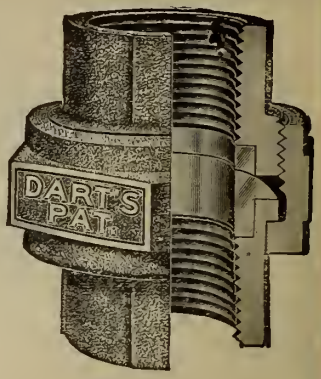
## *THE DIAMOND GRATE BAR COMPANY*

***Head Office and Factory, Berlin, Ont.***

***Branch Office, 118 St. James Chambers, Toronto.*** ***Tel. M 1342***

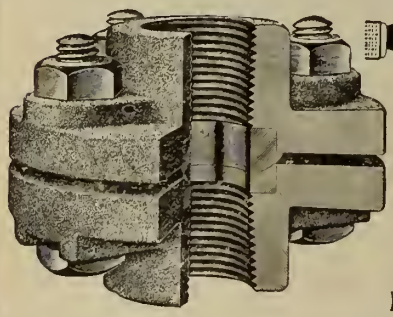



# Why Have That Leaky Joint?




A

# DART'S PATENT UNION OR FLANGE



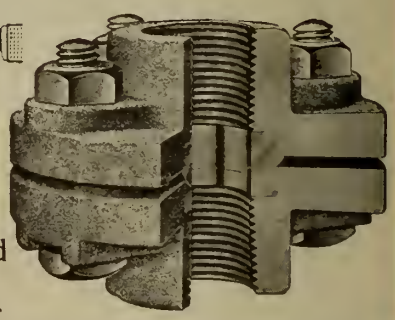
## Will Not Leak

WE GUARANTEE IT

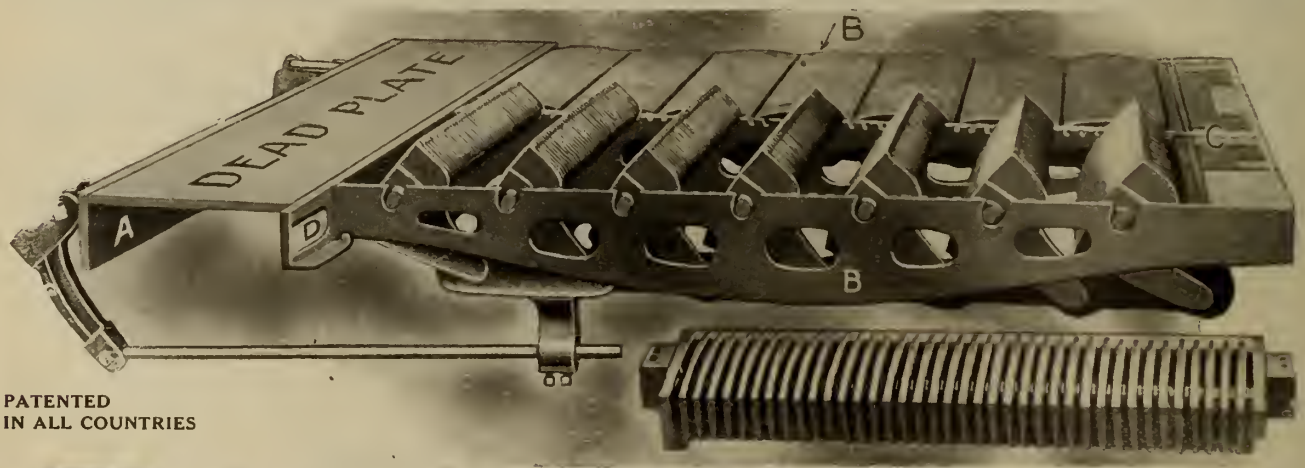
*Look for the name*

Dart Union Co., Limited

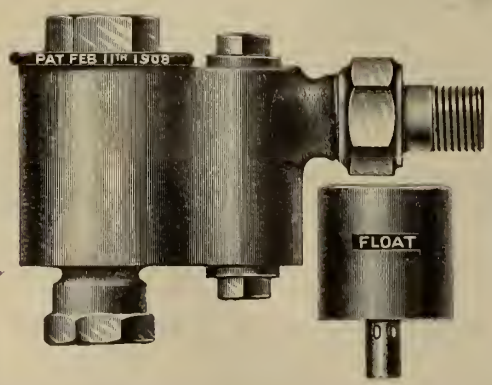
Factory: 93-97 Niagara St., TORONTO, Ont.



## The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES



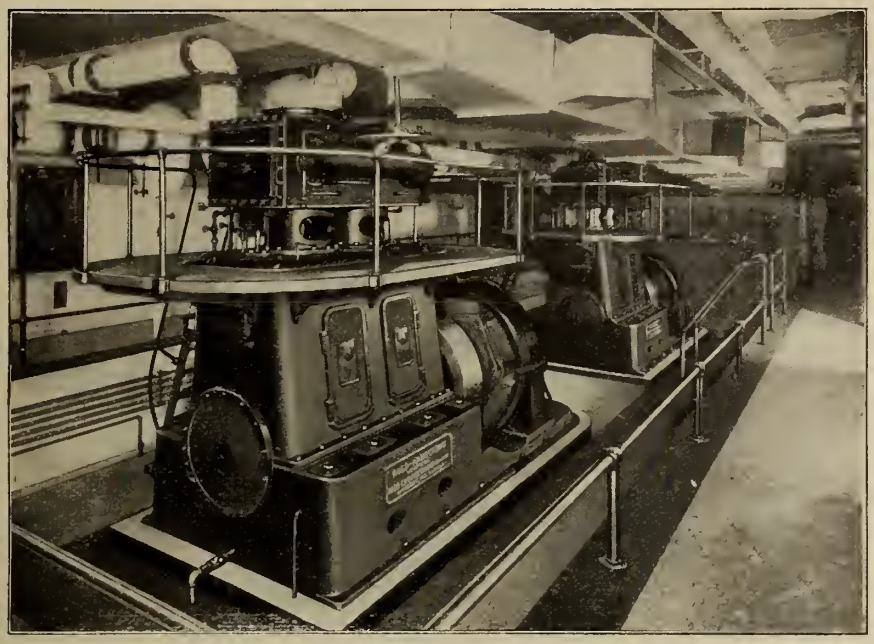

Guaranteed to evaporate more water per pound of coal than any other device—or in other words, will give you more steam, ton for ton, than any other grate bar or stoker manufactured.

Will save you from 10 to 20 per cent. of your fuel bill—guaranteed to last at least twice as long as any bar on the market. In fact our bar is now practically everlasting. Saves the labor and annoyances of the fireman very materially.

We manufacture and control, by letters patent, several Vacuum Steam Heating Specialties. If you are interested in Vacuum Steam Heating you should correspond with us—you can save money by doing so.

**Canadian Steam Boiler Equipment Co.,**
LIMITED

36 and 38 Lombard Street, - TORONTO



# HIGH SPEED VERTICAL ENGINES

of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES { Traders Bank Building, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
Union Bank Building, WINNIPEG; J. F. Porter, Manager

We Guarantee that the

## Triumph Turbine

will furnish more power according to diameter, and give greater efficiency at all stages of gate opening than any other turbine on the market. The cut shows our standard style with vertical shaft. The runner is a single downward discharge, conical in shape, and the buckets are wrought steel with cast iron band around outside. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

*SEND FOR CATALOGUE*

## The Madison Williams Mfg. Co., Ltd., Lindsay, Ontario, Can.

# Heavy Duty Goldie Corliss Steam Engines

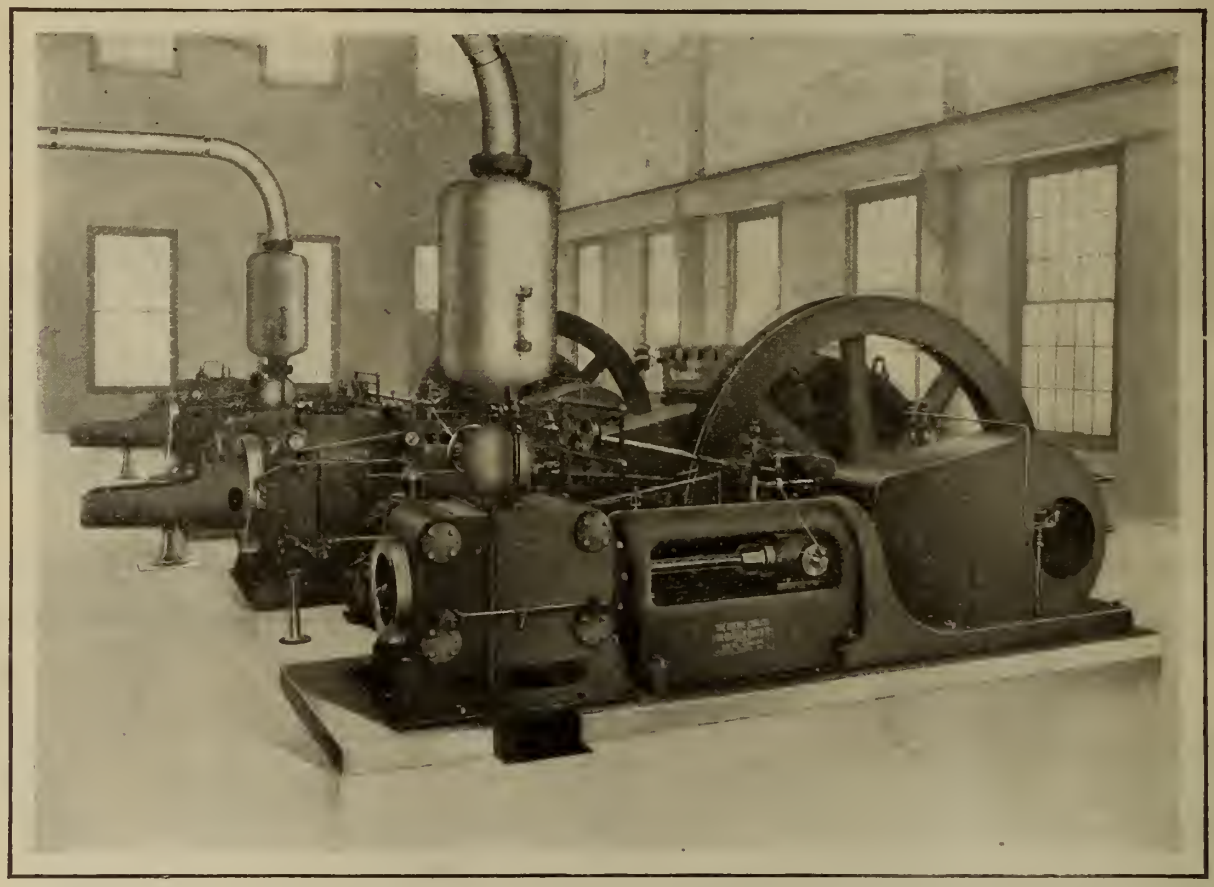


Illustration shows the Power House of the new Grand Trunk Railway Shops at Stratford, Ont., equipped with two Cross Compound Goldie Corliss Engines, direct connected.

## The Goldie & McCulloch Co., Ltd.

### Galt, Ontario, Canada

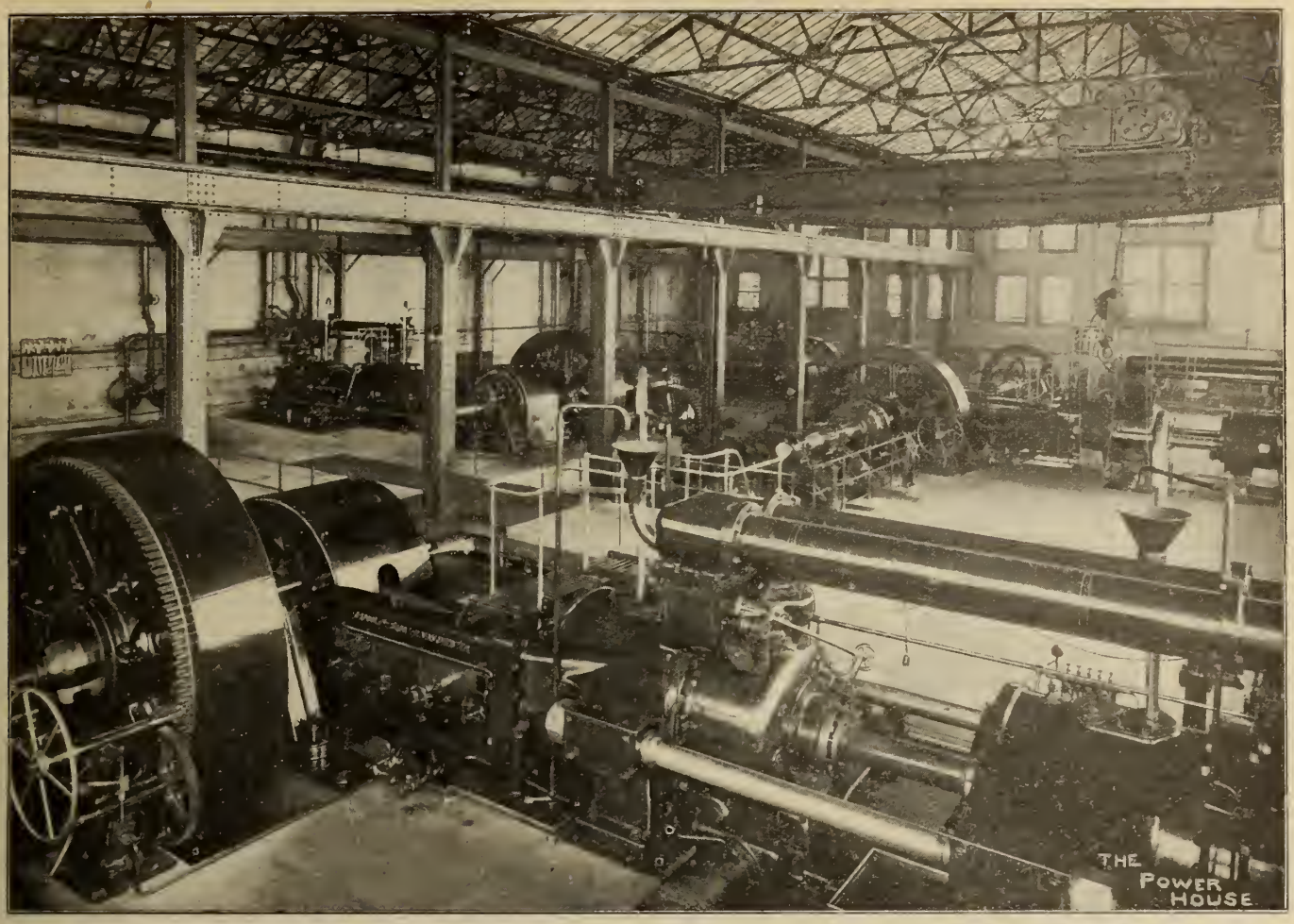
WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B.C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Sawmill Engines, Gas Engines and Producers, Boilers, Special Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION.




Winnipeg High Pressure Pumping Station. Showing in Foreground. one of the High Pressure Power Units.

# Winnipeg's Large High Pressure Producer Gas Instalation

## Pressure Type Plant of Several Units, Totalling 4,500 Horsepower Capacity, Designed to Operate on Various Fuels, Bituminous, Lignite or Anthracite Coal.

In the year 1905, the city of Winnipeg was subject to very excessive fire insurance charges, due largely to the fact that the development of the water works system had not kept pace with the extraordinary growth of the city. As a means of relief, and to place the city in the highest class of fire risks, the City Council backed by the Board of Trade, had a thorough investigation made of fire fighting water works.

Committees of the Council with the city engineer, made several visits to the principal cities in the United States and Canada, where special systems were in use, and, after a careful consideration, determined that the gas engine pumping plant offered, for the conditions of Winnipeg, an economical and satisfactory solution of the problem of fire protection.

It was essential, from the Fire Underwriters' point of view, that any plant adopted should be provided with two independent sources of power. The pumping station of the domestic water works system is about two miles from the business centre of the city, and from the bank of the Red River, from which the water for fire protection was to be obtained.

For alternative sources of power, there are available producer gas and city gas, in addition to a large reserve of producer gas in the holder. Standby losses in fuel in this system are practically nothing.

The first of the pumping units was placed in service in Nov. 1907, and has been available for fire protection since that time. The remaining units were completed and placed in service between that time and the 1st of July, 1908, when the whole plant was practically completed, and its operation taken over by the city.

### The Pumping Station.

The pumping station is situated on the bank of the Red River, at the foot of James Street, only a very short distance from the most congested part of the city.

The six engines are of the Crossley make and are of the "Otto" or four cycle type, having single acting tandem cylinders. The four large engines are of 540 brake horse power each when running on producer gas, the two smaller engines being of 250 brake horse power each. At the present time one of the smaller engines is in operation continuously, the two being run alternately on 24 hour shifts.

The large engines have cylinders 32 inches in diameter with a 36-inch stroke the smaller engines having a 22 inch cylinder and a 30 inch stroke. All parts subject to heating, on account of the high temperature of the exploding gas, are water cooled, and the low tension magneto ignition system is in duplicate. The engines are started by compressed air under 200 pounds pressure. The air compressing plant is in duplicate and consists of 20 horse power

engines driving single acting compressors.

The six engines above described drive six triplex double acting pumps, made by Glenfield & Kennedy of Kilmarnoch, Scotland, shown in Fig. 2. The pumps are furnished with suction and discharge main, 20 inches in diameter, in duplicate, all pumps being connected with both mains, either main being of sufficient capacity for the whole plant.

The pumps take their water from a well, which is divided into two compartments, either of which will supply the whole plant. The water is conducted to the well by an intake pipe 3 feet in diameter, which extends for a distance of 425 feet from the well to the deep water in the river, where it ends in a stone ballasted crib.

### The Gas Producer Plant.

It consists of four Crossley type producers, 2 of 500 h.p., each 8 ft. 6 in. in diameter by 18 feet in height, and two of 1,000 h.p. each 11 feet in diameter and 18 feet in height, with necessary platforms, hoppers and piping.

This plant has an overload capacity of 50 per cent. with selected coal, and readily makes gas from anthracite, lignite or any non-caking bituminous coal. At the present time the plant is being operated on lignite. The coal for use in the plant is delivered on track adjoining the building, and unloaded into a hopper having a capacity of 100 tons.

An elevator fitted with a rotary feeding gear to ensure regular feed without choking, raises the coal to a horizontal conveyor placed above the producer hoppers. The elevator and conveyor are operated by an 8 horse power steam engine. Two air superheaters 18 feet 10 inches by 5 feet 3 inches, and two 18 ft. 10 in. by 4 ft. 3 in. with gas and air connections and dust collectors, are attached to the producers. Each producer unit is supplied with a hot gas tubular boiler.

Four wet scrubbers each 30 feet high by 5 ft. in diameter, fitted with tar sieves and filled with coke, remove the condensible hydrocarbon from the gas. Three centrifugal tar extractors 5 feet in diameter complete the removal of the tar from the gas.

Two sawdust scrubbers, 9 feet by 22 feet, either of which is capable of removing any remaining impurities from the gas, are placed near the inlet to the gas holder. In addition to the above, centrifugal circulating pumps and Root air blowers are provided.

The cleaning plant is operated by two 18 h.p. Crossley gas engines, either of which is of sufficient capacity to drive the whole plant. Two steam boilers of about 50 h.p. each furnish what additional steam is required for the producers, and as well, drive the elevator and blowing engines, and supply steam for heating the building.

The gas holder and pumping station are connected with the city gas mains by a special 12 inch pipe. If for any reason the producer gas system should be out of service, a full supply of city gas may be at once conducted to the holder, or directly to the engines, by a special main provided in the pumping station for that purpose.

A gas holder of 250,000 cubic feet capacity stores a reserve of gas, either producer or city gas, sufficient to operate the whole plant for from 1½ to 5 hours. This will give sufficient time to fire additional producers, or to make provision for the use of the city gas, in case of a long continued fire. It is not likely that more than half the capacity of the plant will be required except in extraordinary cases. So complete is the equipment that all the engines may be started and full load put on the mains in five minutes.

### Capacity of Pumps.

Each one of the four main units is capable of delivering 1,800 gallons of water per minute at a pressure of 300 pounds per square inch, making the total pumping capacity of the plant 9,000 gallons of water a minute. In a recent test made on Portage Avenue, for the Fire Underwriters, seven streams of 2 inches and 2½ inches in diameter were thrown fifty feet over the top of the Somerset building. The gauge pressure at the hydrants was between 270 and 290 pounds per square inch. At the time of making these tests probably one-third of the water being pumped was wasted at the relief valves at the pumping station.

In order to give a good idea of the power of the plant it may be stated that ten streams of 2 inches diameter could easily be thrown over the top of Winnipeg's highest building, the Union bank.

### The Distribution System.

This system consists of 8 miles of mains from 10 to 20 inches in diameter, and 85 fire hydrants. It covers the central, closely built business section of the city.

Two 20-inch mains lead from the pumping station to Main Street by different routes, connecting with submains on the way. Either of these mains, in case of accident to the other, is sufficient to take the water from the pumps when working at their rated capacity.

The mains are designed to withstand the ordinary working pressure of 300 lbs. per square inch, and water hammer. They were tested to 700 lbs. per square inch at the foundry, and after being laid, were tested to from 500 to 600 lbs. The pipes were provided with extra heavy hubs and two lead grooves. These joints have given entire satisfaction.

The hydrants are connected to the mains by 8-inch flanged pipe. They are provided with four 4½ hose nozzles with independent gates. These nozzles are, when required, reduced to 3½ and 2½ inches by suitable reducers, 3½ inch being the largest hose now used.

The hydrant valve is 8 inches in diameter, and is provided with one inch pilot valve to fill the hydrant before opening the main valve against the pressure. Both the valves are operated by the same stem. Each hydrant connection is provided with a gate valve so that the hydrant may be cut out from the system in case of necessity.

---

### WHAT'S IN A NAME?

Walter B. Snow, Publicity Engineer, Boston, Mass., in the Selling Magazine, says: "After all is said and done as regards a reputation we rely upon a name for identification. The mere words of Caesar or Napoleon, Washington or Lincoln, Emerson or Longfellow, raise before us complete life histories. Great names like these give us the standards by which to measure; they are familiar because the individual characters were great; not merely great because they are familiar. Many a name that has resounded in the ears of the world for a few brief weeks or months is now buried deep in oblivion.

"These things are likewise true in the commercial world. A name is worth vastly more than a formula. Imagine trying to popularize Ivory Soap, or Royal Baking Powder by simply publishing the proportions of the ingredients without giving a distinctive name to the product. In the engineering field one might as well simply advertise 'a 16x24 engine running 130 revolutions per minute.' But call it a Corliss engine and its type is determined, designate it as a Harris-Corliss or a Reynolds-Corliss and its character is also made clear. The full value of the name is realized when it becomes in effect a symbol for the product. It becomes a power for suggestion. Instinctively visions arise of pumps or blowers, woodworking or machine tools as we hear the words, Blake or Worthington, Sturtevant, Woods, Sellers or Brown & Sharpe. What is more, each image has character, it marshalls before us in a single impression all that goes to make up the reputation of the given concern and its product. In the creation of this image advertising plays its great and lasting part."

---

One way to keep your credit good is to pay your debts promptly.

# The Transmission of Power by Leather Belting

## Some Points About Belting that May Easily be Overcome by Exercising a Little Care—A Proper Method of Ensuring Long Life to a Belt.

By K. CAMPBELL

I have had occasion to visit several plants recently and could hardly help noticing the various treatments belts receive in different plants from the engineers and superintendents. In one place the belt was much too loose for the work it was performing, and I was not surprised to see it curl up into a roll. The pulley was flanged, otherwise the belt would have run off altogether. Nothing will ruin a belt quicker than an engineer or man-in-charge neglecting to give proper attention to the belts. It pays to install good belting but neglecting it is not conducive to economy.

In another shop a drill press was being run from a countershaft and irons were driven in the floor to keep the belting on the pulley. The belt began to wear from the constant rubbing against the iron. In a flour mill this same method was used but the reports of accidents being caused by explosions of dust made them investigate the causes of belting requiring guides to keep it on the pulley. It was found in this case and also in the former case that the pulleys were out of line and further trouble was eliminated by a few minutes' work.

One engineer was troubled with his engine working loose on the foundations and I saw what the trouble was at once. His belt was running vertically from the engine to the main shaft. The engine was being used temporarily until a larger engine was installed. It was not much work, however, to move the engine and put on a longer belt, giving the belt considerable slant. There was no further trouble from the engine lifting on its foundations, though it was operated several months in this position.

I have read with interest a discussion on a paper, "Transmission of Power by Leather Belting," read before the American Society of Mechanical Engineers at their annual meeting in New York last December. Many good points were brought out, some of which are included in this article.

### The Care of Belts.

One thing that was emphasized was the necessity for systematic care of belting wherever it is used, by a man properly taught this work. The care of belting should be entirely taken out of the hands of the men who are running the various belt-driven machines, and belts should be systematically retightened at regular intervals, with belt-clamps fitted with spring balances, each belt having the tightening strain carefully figured in advance. Belting should also be cleaned at regular intervals, and should be softened with the small amount of belt-dressing which is needed to keep it in perfect condition. All work on belting should be done under the supervision of the engineer. One of his assistants can be trained to tighten and care for belts during the noon hour on Saturday afternoons and at other times when the shop is not running.

### System of Caring for Belts.

Mr. Walter C. Allen, of the Yale & Towne Mfg. Co., gave the Mechanical Engineers' Association same valuable data in regard to the care of belts in the Yale & Towne works. Previous to taking systematic care of the belting in the works referred to, the machine belts were cared for by the individual machine operators, many of whom knew absolutely nothing about belting. The heavy belts were attended to by the engineering department, only when they gave way or stretched. Sometimes when a belt on a machine stretched the machine operators cut out too much and had to set in a piece in order to make the belt long enough to do the work.

Under the new plan the belting is regularly and carefully inspected and records made. Four men have charge of the department and the telephone brings one to the seat of any trouble. The men lunch between eleven and twelve and are thereby enabled to make any repairs without loss of time to the other employes.

### Fastening.

Under the old plan there was no fixed rule regarding the fastening, rawhide lacing and belt hooks being used indiscriminately. Under the present plan wire lacing, put into the belts by means of a machine, is universally used. For continuous belts, under the old plan, a kind of glue which took from three to ten hours to set satisfactorily was used. Under the present plan a special glue is used which will set hard in thirty minutes. This also results in a saving of time in the case of an accident to continuous belts.

### Belt Dressing.

Under the old plan comparatively little belt-dressing was used, but in many cases rosin was used through ignorance of the fact that it causes the belting to deteriorate rapidly. A good belt-dressing, which is extremely useful and tends to prolong rather than to shorten the life of the belt is now used.

### Reclamation of Oily Belts.

Under the old plan no reclamation was attempted, but at the present time a considerable amount of belting is reclaimed each year. Belting damaged on the edges is cut down and used for narrower belts, short pieces are scarfed and glued together and the oil is taken out of oily belting and the belts used over again.

### Kind of Belting.

Several kinds of belting were used under the old plan, but the belting has been gradually standardized, until at the present time practically nothing but a high-grade of oak-tanned belting is used.

The foregoing statements describe briefly the various features of the old and the new plans at the Yale & Towne Mfg. Co.'s works. A summary of the advantages of the new plan follows:

(a) Decreased cost of belting. The cost for the year 1907 was only about 60 per cent. of that of 1906 despite the fact that we installed more new machinery in 1907 than in 1906.

(b) Increased efficiency of machines due to the fact that the tensions are maintained much more uniformly than formerly.

(c) Continuous production by both men and machines, due to decreased interference due to belt-breakdowns.

(d) Uniform type of belt lacing, decreasing danger to employes.

(e) Decreased cost of maintenance.

(f) Under the present plan the cost of maintenance appears as a separate item where it can be watched and compared with that of previous periods to determine the relative economies, while under the old plan the figures were combined with a mass of others so as to make it impossible to determine how much it had cost.

---

### NEW INSULATOR.

Oxybenzyl-methylenglycol-anhydride is the chemical name of a coal-tar product which is being used as an insulator. However, it goes by a trade name of bakelite after the inventor, Dr. L. H. Bakeland. It is stronger than hard rubber, withstands a higher degree of temperature, and is unaffected by most chemicals. It has been used for insulators and also to impregnate soft wood, causing the latter to become as hard as ebony. Generators and motors have been impregnated with the bakelite to protect the wiring.

Mines of Asbestos and Asbestic Co., Danville.

# Commercial Application of the Mineral Asbestos

## Asbestos for Hot and Cold Insulation, Fireproofing, Etc.—In the Province of Quebec are Asbestos Mines which Rival the Gold Mines in Wealth.

By J. F. ARROWSMITH

Used as a covering for steam pipes or spun into wick as steam packing, asbestos is known to every engineer. The applications are many and varied. The heat-resisting qualities have made it specially adaptable to prevent heat radiation in superheated steam pipes. It is extensively used for theatre curtains, fireproof cloths or fabrics, electrical insulation, cold storage, fireproof safes, and, mixed with other substances, it forms many incombustible and insulating materials, such as asbestos for plaster, asbestos building lumber, shingles and asbestos paste or cement for electrical insulation.

Asbestos is one of the fascinating minerals with the silky structure of the thistledown. As the name implies, asbestos—inconsumable—is almost indestructable and can stand temperatures of 2,000 and 3,000 degrees Fahrenheit. On some varieties no visible effect has been produced by a temperature of 5,000 degrees.

Asbestos is so different from every other mineral that its preparation for commercial use is peculiar to itself. The use of asbestos can be traced back to ancient times but Italy is really the pioneer in the mining of asbestos in commercial quantities. Other countries with asbestos mines are Russia, United States, Australia, Newfoundland and South Africa. In 1862, when British capitalists were exploiting asbestos in Italy, discoveries were made in Canada in the vicinity of Des Plantes River, in the Province of Quebec, and specimens from this district were exhibited in London in 1862.

It was in 1877 that the well-known asbestos regions at Thetford were discovered. The following year shipments were made to London, and experiments, tests and investigations followed. These resulted in the development of the Quebec asbestos mines. The manufacture of asbestos products is now one of the most prosperous industries in the Dominion of Canada.

Mills of King's Asbestos Mines.

Derrick and Hoists—King's Asbestos Mines.

Two distinct minerals are found in Canada, known as amphibole or hornblende asbestos, and serpentine asbestos. To the first belongs the actinalite mined at the village of Actinolite, north of Tweed, Ont. This has a blackish green

appearance and is divided in its manufacture into grades and is used chiefly for pipe covering or plaster, depending on the grade. The plaster is used in hospitals for contagious diseases as it does not carry the germs.

To the serpentine belongs the chrysolite asbestos found in Quebec, of length, fineness, elasticity and durability, to make it of great economic value. Chrysolite is a hydrous silicate of magnesia. The approximate com-

Asbestos in Natural State.

position of the asbestos is as follows: Silicia, 40.52; magnesia, 41.95; ferrous oxide, 1.97; alumina, 2.10, and water 13.47.

### Uses of Asbestos.

Asbestos plays, in a variety of forms, a very important part in the domestic and mechanical arts of every-day life. The list of its commercial application is surprisingly comprehensive, and develops in conjunction with the progress in mechanical and domestic arts. In fact, asbestos is used in many cases without any knowledge of the fact. The housekeeper who first made her acquaintance with asbestos as a stove-mat, now uses it as a stove polisher, as a sad iron holder, as a lamp wick, and as a fire pad under her gas burner, while her kitchen range and her stove are lined with it. Dwelling houses are fireproofed with asbestic wall plaster, asbestos roofing material, and asbestos paint. In office buildings and factories the steam pipes are overlaid with asbestos covering, and the boilers with asbestos cement. Engineers use asbestos yarn or wick for packing piston rods and valve stems, and asbestos millboard as a joint packing. Electricians value it as a non-condnctor. The modern theatre has fireproof stage curtains of asbestos cloth, and the best equipped firemen wear asbestos uniforms. Storage rooms on ocean steamships are lined with asbestos, and it is equally serviceable in the domestic refrigerator. Chemists find asbestos fibre the best filtering medium, and because of its non-absorbing and antiseptic qualities it is valued in hospitals. In fact it saved many lives during the Boer War by preventing gangrene. It can be easily seen that a substance that fire cannot burn, that eating acids will not touch, is invaluable in every branch of life.

As a steam packing, asbestos is very durable, and economical. It stands high heat or moisture and does not need to be frequently renewed. The asbestos on account of its nature is rather elastic and keeps the joint tight. The elasticity is sometimes increased by the use of a rubber core. Packings are made in sheets with rubber between two layers of asbestos and are used with great success as flat joint packings. Other packings are twisted and in some wire is used to increase the durability and strength.

Mills of Beaver Asbestos Co.

Many combinations of asbestos, wire and rubber have been made. One economical form of asbestos tape. This has the advantage of having no waste, as it can be easily bent into the form of a ring. This form, combined with rubber, is very much in use and can withstand high steam pressures and moisture.

### Mining, Milling and Manufacturing.

No expensive apparatus is needed in the actual mining of asbestos, no need of tunnelling, although this has been attempted with varying success at one or two mines to escape the rigors of winter.

Pit of King's Asbestos Mines.

The crop is quarried in the open as marble is worked, and the rock is taken down in a series of benches or terraces which vary in dimensions according to the sizes of the pits. The main essentials to render asbestos of economic value are, length, fineness and elasticity of fibre, tensile strength, and power of fire resistance. The Canadian article possesses all these qualities, hence the extent of its markets.

Although the first discoveries of asbestos were made in 1862 in the Des Plantes River region, followed in 1877 by discoveries in the Thetford and Coleraine districts, mining operations only commenced in 1878, and that on a very small scale. In the succeeding ten years the industry developed rapidly. No mechanical means were employed at the time to separate the smaller asbestos fibres from the adhering rocks, and it was found that only the mines which had a large proportion of crude asbestos could continue profitable operation, by reason of the heavy cost of cobbing the poorer varieties. Consequently, the industries in the middle nineties received a severe setback. Repeated experiments, however, on the part of those engaged in the industry evolved a method of mechanical treatment, which in the course of years has been improved, until at the present time every mine in the asbestos district is equipped with a complete milling and fibreizing plant. By

this method of treatment all the smaller fibre, which in earlier years was left in the rock and thrown on the dump, is now saved. Since then, new uses for this short material having arisen, the total value of the mill fibre is at present in excess of the total value of crude asbestos produced, in fact, some properties which produce no crude asbestos are successfully operating.

Dominion Asbestos Company's Pit No. 1, at Black Lake, Quebec.

As has been said, mining itself is a simple operation, although the fibreizing and manufacturing processes are complicated. Dynamite is employed to break up the rock, the pieces being sorted in the pit into crude, or long fibres—usually in the compact masses as it occurs in the vein—and milling rock. The finer and larger the vein, the easier, it is, of course, detached from the rock. These products are hoisted separately in boxes by means of boom and cable derricks. The crude and the mill rock are sent to the cobbing sheds and mill respectively. The crude is cobbed by hand and cleaned, and is separated into two quality grades. The mill rock which ranges from 30 to 80 per cent. of the total rock hoisted undergoes a system of treatment which is peculiar to this industry. Hardly any two mills are alike in their method of treatment, although the general process is the same The rock is sent to the mill bins, while the fines, or shorter asbestos, from the pit undergo a preliminary drying before crushing. This drying is either performed by rotary dryers, or by coils treated by exhaust steam. All the mill material is then sent to a coarse jaw crusher, passing thence to picking belts, and thence to a rotary crusher. The crushed rock is delivered to a shaking screen, and any fibre which may have been liberated by the coarse crushing is sucked from the screen by an exhaust fan. The rest of the coarse rock and fibre passes to either rolls or grinders, and is sent to another shaking screen, and the liberated fibre is sucked from this screen by another exhaust fan, while the rest of the coarse material passes to the cyclones or fibreizers.

While the method of coarse crushing may vary considerably in the different mills, the cyclone is used in the majority of the mills, and forms one of the integral parts of asbestos separating machinery. It consists of two beaters—of a screw propeller type, encased in a cast iron chamber—which beaters are driven at a speed of 2,000 to 2,500 revoluctions per minute in opposite directions. The material is fed to this chamber, and the whirlwind created by the beaters hurls the particles against each other, thus reducing them in size, and liberating the fibre from the rock. The material is discharged from the fibreizers to a shaking screen, and an exhaust fan sucks the fibre from the screen. The residue is sent to the dump. The fibre extracted is then sent to grading screens. and various other devices which separate the fibre into its various grades. The fine sand from all the screens passes to the dump cars. As might be expected with such a process, numerous changes are made from time to time in the design of new mills. Asbestic, which is largely used for fireproof plaster, is made from the ground up tailings of the mill.

### Just Like Wool.

The manufacturing of the fibres into the various articles for which they are best adapted is a complicated process, but the initial preparation is very interesting and worthy of mention. The fluffy stuff from the mills goes to the carding room of the manufacturer just as though it were genuine wool sheared from a sheep, or pure cotton fresh from the plant, instead of a mineral substance that in its original state was mined like a lump of coal. A carding machine, similar to that employed in preparing wool, cotton, or flax fibres before spinning, has been adopted. By this means the fibres are straightened out, and their irregularities eliminated. A fly comb converts the stuff into unspun threads, which are then gathered into rows and condensed. The spinning of the threads brings the manufacture of the fireproof material to the point where it is woven into cloth, packing, and the other forms we have previously mentioned.

Dominion Standard Asbestos Company's Milling Plant at Black Lake, Quebec.

---

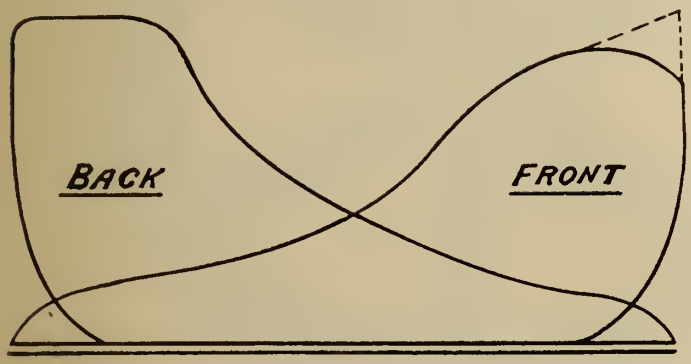
R. J. Park, consulting engineer, Toronto, left on April 9 on the Empress of Ireland for a business trip to Europe. He will visit London, Paris and Berlin.

# Robb-Armstrong Corliss Valve Gear and Valve Setting*

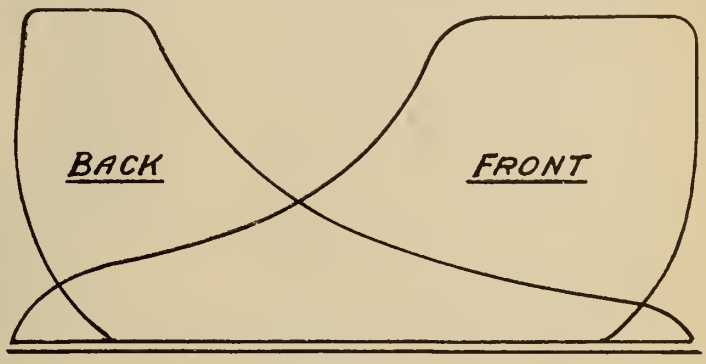
## Special Features of the Valve Gear on Robb-Armstrong Engines—Directions are Given for Setting the Valves, also Effects of Changing Valve Gear.

The Armstrong Corliss valve gear used on Robb-Armstrong engines, the principle of which is shown in the outline sketch, is the invention of E. J. Armstrong, M.E., the special advantages of it being that there are no springs, dash pots or disengaging parts. By the introduction of two small links between the wrist plate and bell cranks, the steam valves are caused to open and close quickly, and remain stationary during the remainder of the stroke, the action being almost precisely the same as with the releasing gear invented by George G. Corliss, but as this valve gear is positively driven, and does not depend on springs or dash pots for closing, it may be operated at much higher speed than the releasing valve gear, and as there are only about half as many pieces and wearing surfaces, and no latches or detachable parts, the gear runs very smoothly and without noise. All the important wearing parts of the valve gear are enclosed in a casing and run in oil, so that friction and wear, so detrimental to the releasing style of valve gear. is entirely eliminated.

The valves are of the usual Corliss rotative type, of the latest design, triple ported, giving very short travel and quick opening. The exhaust valves are driven from a wrist plate in the usual way.




Card No. 1.




Card No. 2.

The automatic cut-off is obtained by means of the Robb-Armstrong-Sweet shaft governor, located in the driving wheel of the engine, so arranged that the cut-off of the valves is controlled directly by the action of the governor. This method of governing is much more positive, quicker in action and gives closer regulation than the indirect method of governing used in connection with releasing gear.

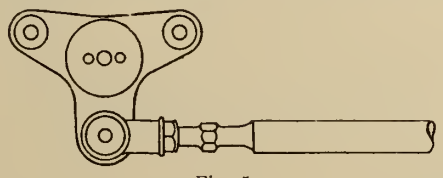


Fig. 5.

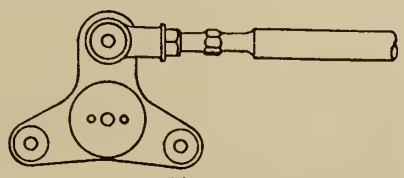
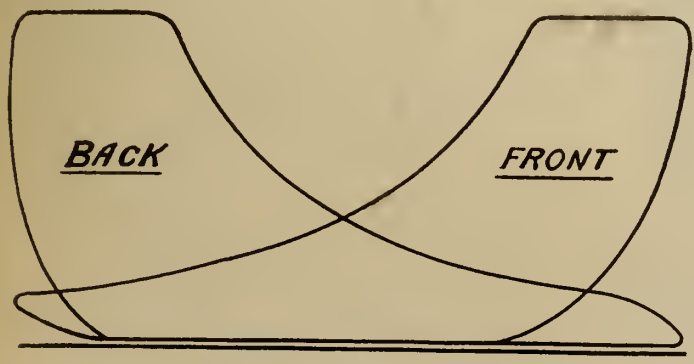


Fig. 6.

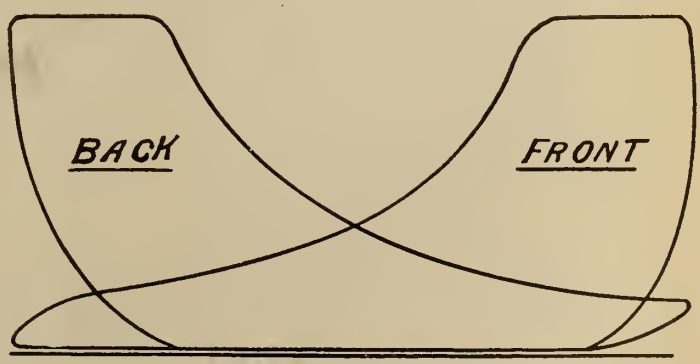
### Shaft Governor.

Although the design of centrifugal governors has occupied the attention of engine designers and builders ever since steam engines have been used, particularly that form of governor which is placed in the fly wheel of the engine and is attached directly to the valve-driving mechanism, it has been found especially difficult to get a governor powerful enough to operate the valves and valve gear regularly, and, at the same time, to give sufficiently close and quick regulation to meet the very exacting requirements for driving electric generators, particularly for lighting or combined lighting and power service and for parallel operation of alternating current generators.

The real controlling power in a governor depends upon the amount of the unbalancing of the centrifugal and centripetal forces. If the centrifugal and centripetal forces are strong, a small change in speed will cause a considerable unbalancing of these forces and a correspondingly quick change of the governor to a new position where the




Card No. 3.



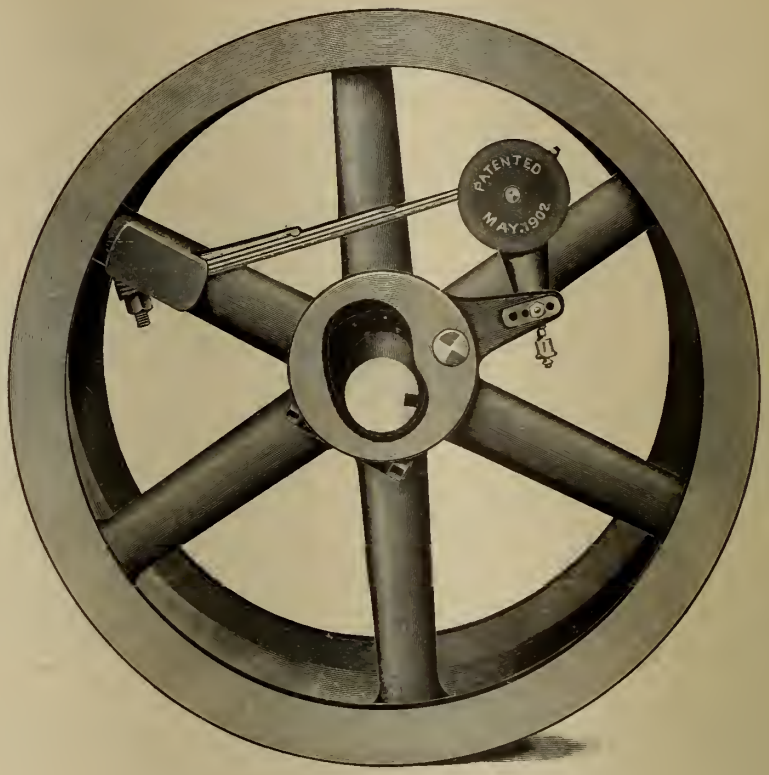

Card No. 4.

*First article of a series on the setting of valves on the different makes of engines on the Canadian market.

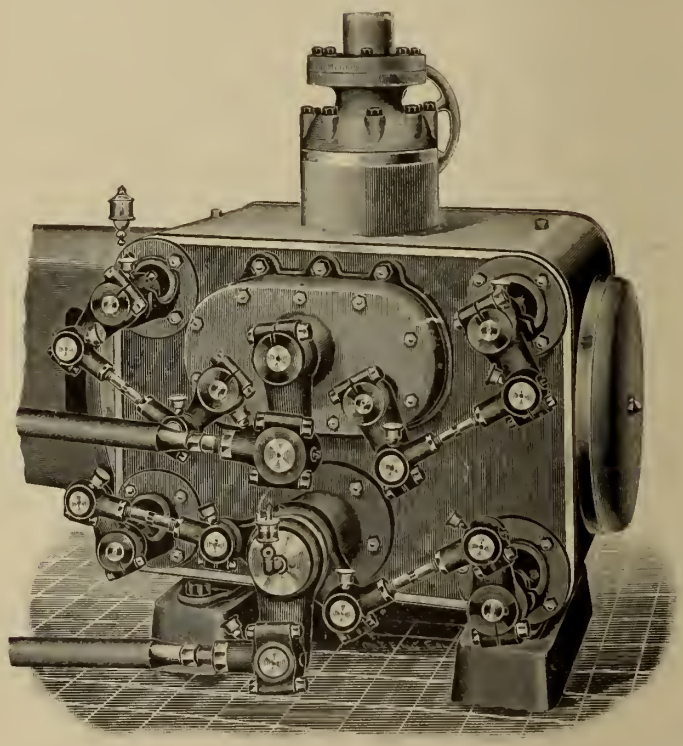
forces are again in balance. If there were absolutely no friction or inertia in the moving parts of the governor, any unbalancing of the forces would cause the governor to move instantly to a new position where the balance would be restored. The more friction there is, the slower the mechanism will adjust itself to the new position, and the effect of slow movement is that the governor will move too far and then come back, and there will be a constant hunting, to find the proper position.

The governor invented by Professor John E. Sweet was a decided advance over earlier types, having a less number of parts, only one weight and one spring, the governor system in gravity balance in all positions, the great centrifugal power with less friction in the moving parts than previous forms of governor.

The inertia governor, which forms another step in advance, is so arranged that any change of speed of the engine causes the fly wheel and the suspended inertia weight or arm to which the eccentric is attached to change their relative positions, so that the cut-off is changed quickly to meet a sudden change of load. The inertia of this heavy arm also prevents, to a certain extent, disturbance of the governor by the reciprocating motion of the valve gear. The disadvantages of governors of the purely inertia type are: (1) That the inertia weight and eccentric being all in one piece, must be out of gravity balance in order to have centrifugal force, and not being in balance, will oscillate, especially at slow speeds. (2) The strain, due to the centrifugal force and gravity of the heavy inertia arm, is carried directly by the suspension pin, making great pressure and friction on that pin, which is not easily lubricated. (3) As the inertia governors of the designs referred to cannot have centrifugal force without being correspondingly out of gravity balance, nor without great strain and friction on the suspension pin, they are designed for very small centrifugal force, with the result that the regulation is influenced greatly by the variation in the friction of the valve or valve gear, tight or loose packing of the valve rod, change of steam pressure, etc., and if the suspension pin gets dry, the governor regulates badly.




Robb Armstrong Governor.

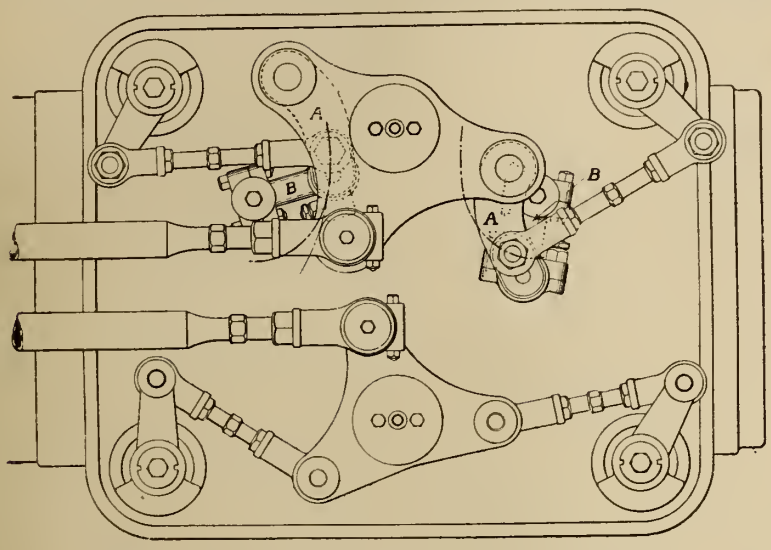


Armstrong Valve Gear.

### Robb-Armstrong-Sweet Governor.

The Robb Engineering Co. made a study of the question of shaft governors and worked out the Robb-Armstrong-Sweet governor now used by that firm. The following advantages are claimed for it: (1) The centrifugal weight is carried by the spring directly, so that the heavy strain due to centrifugal force is not brought on the suspension pin, which merely carries the eccentric and is not subject to any strain or friction except that due to the driving of the valve gear. (2) The governor system is in gravity balance in all positions, because the eccentric is made to balance the centrifugal weight, the principle of balancing being the same as that invented by Professor Sweet and employed in the straight line engine governor. (3) The centrifugal weight may be very heavy without bringing undue strain on the spring, because a large part of its centrifugal force is carried by end pull on the flat leaf spring, and, therefore, the inertia of the weight is sufficient to prevent

disturbance by the reciprocating motion of the valve gear. (4) The weight is so placed that it gets the effect of inertia for quick regulation. The result is a simple and powerful, governor in which there is not enough friction to prevent the governor from changing almost instantly, and no possibility of racing when properly adjusted.




Outline of Robb Armstrong Valve Gear with Case Removed.

### Setting the Valves.

To one unaccustomed to setting Corliss or other engine valves the task is a perplexing one and the efficiency of results obtained will be in direct proportion to the experience and judgment of the person undertaking the work. Conditions of pressure, speed, weight of reciprocating parts, clearance and numberless other influences enter into the problem to such an extent that it would be impossible to set down rules that would insure good valve setting without the aid of good judgment in addition to the information given. In what follows, no attempt is made to explain more than the causes and effects brought about by certain changes in valve gear adjustment.

Taking an engine the valves of which have not heretofore been set, first adjust the valve links so that they are about of equal lengths centre to centre, and so that the steam valves during closed period lap from 3-16 inch to 7-16 inch. Set the steam reach rod so that the cut-off is about equal at each end of the cylinder, then attach the indicator to the cylinder.

### Equalizing the Cut-off on Steam Valves.

The cut-off will to a large extent be equalized by an adjustment of the length of the steam reach rod and can be done without paying much attention to the lead at first, but as soon as the cards show the cut-off to be approximately equalized the lead may be corrected up.

### Setting the Lead.

The indicator cards will probably show too much or too little lead, and in order to get this right, lengthen the valve links so that the cards will show a full square lead line at one quarter cut-off. The links may now be shortened until the cards show a rounded corner or receding lead line. This will show that the lead setting is just on the turn and the links may be again lengthened slightly to bring the card back to square at the lead corner. This adjustment will probably give negative lead throttling the steam at early cut-off and it is left to the discretion of the erecting engineer whether the links should be lengthened a little more to square the cards up at early cut-offs, but it will be found that better regulation can be obtained by throttling slightly at no load.

### Equalizing the Valve Opening.

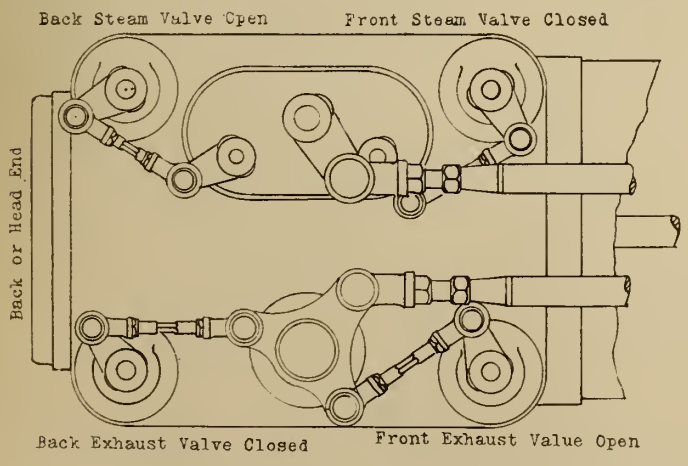
Occasionally some difficulty is found in getting the indicator cards to look the same for each end of the cylinder even after getting the lead and cut-off equalized. The trouble comes from an unequal valve opening and can be cured by a combined adjustment of the links and reach rod.

If the cards have a low steam line or receding line as dotted on the front in Fig. 1, the natural tendency will be to get more lead and opening on the front by shifting the reach rod, but the result still proves unsatisfactory because by the time the steam line is brought up sufficiently the cut-off at the front will be found to be too late, as shown in the cards Fig. 2.

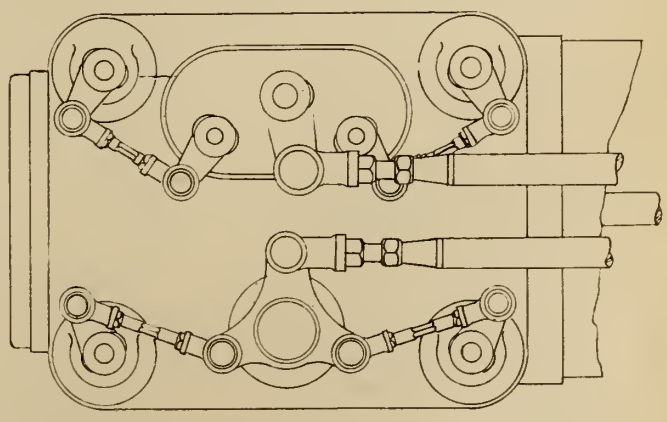
To raise the steam line on the front or to overcome this difficulty, shorten the front valve link, lengthen the back valve link an equal amount, and lengthen the reach rod until the cut off is equalized again. These changes do not materially affect the ultimate lead and cut-off and when the reach rod is re-adjusted the lead and cut-off should come right, and the steam line on the front will be found to have been corrected or improved.

The amount of change necessary in lengths of links and reach rod will depend upon how much the cards are out, but it is well to rather exaggerate the changes at first so that results may be arrived at quickly.

To raise the steam line on the back. Shorten the back valve link, lengthen the front valve link an equal amount,




Armstrong Corliss Valve Gear.



Wrist Plates Central, all Valves Closed.

and shorten the reach rod until the cut-off is equalized again.

### Setting Exhaust Valves for Release and Compression.

To set the exhaust valve gear, the exhaust reach rod should first be adjusted so that the exhaust wrist plate travels about an equal amount each side of the central or vertical position. The valve links should now be equalized and the cards will be found to be fairly well equalized.

### Later Release and Less Compression.

If a later release and less compression is required, the exhaust eccentric sheave should be turned backwards, opposite to the direction of rotation of the engine shaft.

For earlier release and more compression turn the exhanst eccentric sheave forward.

For later release and more compression lengthen the exhaust valve links.

For earlier release and less compression shorten the exhanst valve links.

If the exhaust valve links are shortened any great amount, the valve caps should be removed to see that the valves still lap sufficiently, during closed period, that they will not leak steam.

For earlier release and same compression turn exhanst eccentric sheave forward and shorten both exhaust valve links. The combination of both changes tends to make the release earlier, and one works against the other to keep the compression the same.

To obtain later release and same compression turn exhaust eccentric sheave backward and lengthen both exhaust valve links.

To obtain same release and more compression turn exhaust eccentric sheave forward and lengthen both exhaust valve links.

For same release and less compression turn exhaust eccentric sheave backward and shorten both exhaust valve links.

Occasionally a case may arise where the release and compression do not equalize for each end of the cylinder (see Fig. 3 and Fig. 4).

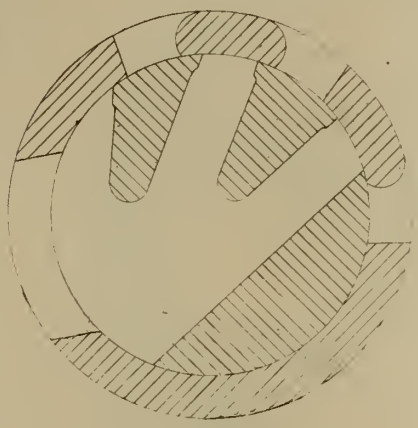
If release is too late and compression too high, front end of cylinder, correct it by shortening exhaust reach rod (changes both ends in opposite ways) or by shortening (front) exhaust link rod (changes only one end).

If release is too late and compression too high, back end of cylinder to correct it by lengthening exhaust reach rod (changes both ends in opposite ways) or shortening (back) exhaust link rod (changes only one end).

Shortening exhaust reach rod gives earlier release, less compression (front) later release, more compression (back)

Lengthen exhaust reach rod gives later release, more compression (front), earlier release, less compression (back).

Shorten front exhaust link rod gives



End Section Admission Valve.

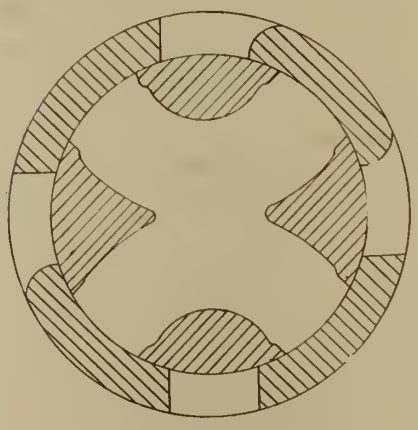
earlier release, less compression (front), no change release and compression (back).

Lengthen front exhaust link rod gives later release, more compression (front) no change release and compression (back).

Shorten back exhaust link rod gives no change release and compression (front). earlier release less compression (back).

Lengthen back exhaust link rod gives no change release and compression (front), later release more compression (back).

In some engines the exhaust wrist plate turns down (see Fig. 5), instead of up (see Fig. 6).



End Section Exhaust Valve.

When it turns down like (Fig. 5), the operations in regard to the exhaust reach rod should be reversed as follows: When directed to lengthen, exhaust reach rod should be shortened; when directed to shorten, exhaust reach rod should be lengthened.

### THE McCHARLES PRIZE.

In view of the great interest now being taken by Canadians in all developments in the natural resources of the Dominion, the bequest of the late Aeneas McCharles providing a fund for the purpose of recognizing the inventions or discoveries of special merit made by Canadians will be welcomed by all.

In connection with the bequest of the late Aeneas McCharles of Provincial Government bonds of the value of $10,000, on the following terms and conditions, namely, that the interest therefrom shall be given from time to time, but not necessarily every year, like the Nobel prizes in a small way ; (1) To any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale ; (2) Or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light ; (3) Or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions, as passed by the Board of Governors, determine the method of award :—

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00).

(3) The term "Canadian" for the purposes of this award shall mean any person Canadian born who has not renounced British allegiance ; and for the purposes of the award in the first of the three cases provided for by the bequest, domicile in Canada shall be an essential condition.

(4) Every candidate for the prize shall be proposed as such in writing by some duly qualified person

(5) The order of priority in which the three cases stand in the wording of the bequest shall be observed in making the award ; that is, the award shall go caeteris paribus to the inventor of methods of smelting Canadian ores ; and, failing such inventions, to the inventor of methods for lessening the dangers attendant upon the use of electricity ; and only in the third event, if no inventors of sufficient merit in the fields of metallurgy and electricity present themselves, to the inventor distinguished in scientific research.

All communications in connection with this award should be addressed to the Secretary of the McCharles Prize Committee of Award, University of Toronto, Toronto.

# Course of Lessons for the Instruction of Stationary Engineers

## Fifth of a Series of Interesting Educational Articles—This Article Contains Problems which are Fully Worked Out and Answers Given.

Formula 1.—The following formula will be found very nearly correct for determining the latent heat of steam at any temperature.

Latent heat =966.6—(t—212 deg.) 7 where t = the temperature of evaporation.

From this we see that as the temperature of steam is raised, the latent heat diminishes only 7-10 of the increase in the sensible heat. It is obvious that the total heat increases. For all temperatures above 212 the latent heat is less than 966.6, and for all temperatures below 212 the latent heat is greater than 966.6.

When the latent heat is found at any temperature the total heat of evaporation is easily determined.

Formula 2.—Total heat = sensible + latent heat = (t—32)+966.6—(t—212 deg.).7=1083+.3t.

Example: Steam at 100 lbs. absolute pressure has a temperature of 327.6 deg. F. What is the latent heat, also the total heat of evaporation?

By formula 1. Latent heat =966.6—(327.6—212).7=966.6—80.92—885.78.

By formula 2. Total heat of evaporation =(327.6—32)+966.6—.7(t—212) =295.6+966.6—80.92=1181.28 heat units, or 1083+.3t. 1083+(.3×327.6)= 1083+98.28=1181.28 heat units.

### Problem 2.

Find the latent heat together with total heat of evaporation, in steam having a temperature of 320 deg. F.; using the above formula?

Formula 1. Latent heat =966.6—(320—212).7=966.6—75.6=891.

Formula 2. Total heat of evaporation =(320—32)×966.6—.7 (t—212)= 288+966.6—75.6 = 1254.6—75.6 = 1179 heat units. Ans.

### Problem 3.

What is the latent heat of steam when the thermometer registers 332 F?

Latent heat =966.6—(332—212).7 by formula 1 = 966.6—120×7=966.6—84. =882.6 deg. Ans.

### Problem 4.

Find the total heat of steam at 212 deg. F.

By formula 2 (212—32)×966.6—.1(t—212)=180+966.6—0=1146.6. Ans.

### Problem 5.

Calculate the heat required to change 5 lb. of water at 32 degrees into steam at 92 lb. pressure above vacuum; temperature at 92 lb. pressure is about 322 deg. F. (332—32)+966.6—.7(322—212) =290+(966.6—.7×110=290+(966.6 — 77)=290+889.6=1179.6 B.T.U. of 1 lb. at 92 lbs. pressure. This 1179.6×5= 5898 B.T.U. Ans. Or 1083+.3t=1083 +96.6=1179.6.

1179.6×5=5898 B.T.U.

### Problem 6.

How many heat units are required to raise 8½ lbs. of water from 32 deg. to 250 deg. F.?

(250—32)×8½=218×8½=1153 B.T.U.

### Problem 7.

How many foot pounds of work will it require to change 60 lbs. of boiling water at 80 lbs. pressure absolute, into steam of the same pressure? Temperature of 80 lbs. absolute = 311.866.

Ans. by formula 1. 966.6—(311.866—212).7=966.6—99.866×.7=966.6 — 69.9062=896.7 B.T.U. to change 1 lb. of water at 80 lbs. pressure into steam at the same pressure.

Therefore 896.7×60×78=53802×778 =41,857,956 ft. pounds.

### Problem 8.

By Regnault's method.

(a) H=1081.94+305.t.

(b) Formula 2. =1083+.3t.

What is the total heat of 25 lbs. of saturated steam having a temperature of 340 deg. F. 119 lbs. pressure absolute?

By formula (a). 1081.94+340×.305 =1081.94+103.7=1185.64 B.T.U. total heat of 1 lb. of steam at 340 deg. F.

1185.64×25=29,641 B.T.U.. Ans.

By formula (b). 1083+.3t=1083+.3 ×340=1083+102.0=1185 B.T.U. total heat of 1 lb. of steam at 340 deg. F.

1185×25=29625 B.T.U. Ans.

### Problem 9.

What is the total heat of a pound of steam at a pressure of 90 lbs. gauge 332 deg. F.?

90+15=105. 332 deg. F.

90+14.7=104.7. 331 deg. F.

By formula (a). Regnault's method.

H = 1081.94+332×.305 = 1081.94+ 101.26=1183.2 B.T.U.

H = 1081.94+331×.305 = 1081.94+ 100.955=1182.895 B.T.U.

By formula (b), as used above (formula 2):

H = 1083+.3×332 = 1083+99.6 = 1182.6.

H = 1083+.3×331 = 1083+99.3 = 1182.3.

### Problem 10.

What is the latent heat of vaporization corresponding to a pressure of 200 lbs. absolute? Temperature 381.636 deg F.

By formula 1. Latent heat=966.6—(381,636 — 212).7=966.6—169,636×.7= 966.6—118.7452=847,8548 B.T.U. Ans.

### Problem 11.

The volume of a pound of steam in cubic feet is found approximately by Rankin's formula:

$$P.V.^{\frac{17}{16}} = 475.$$

P=pressure in pounds per square inch.

V=volume in cubic feet of a pound of steam at the given pressure.

Find the volume of a pound of steam at 10 lbs. pressure absolute (per square inch).

$$10\ V^{\frac{16}{17}} = 475.$$

$$V^{\frac{17}{16}} = \frac{475}{10} = 47.5.$$

$$V^{\frac{17}{16}} = \log.\ 47.5 = 1.67669.$$

$$\text{Log. } V = 1.67669 \times \frac{16}{17} = 1.57806 =$$

37.85 cubic ft.

(These problems will be continued in the May issue.)

---

### ENGINEERS' ACT AMENDED.

1. The clause (a) in section 3 of The Act respecting Stationary Engineers, passed in the 7th year of His Majesty's reign, Chapter 32, is amended by adding thereto the words "provided that no person shall be eligible for such examination unless he is a British subject or has resided in Canada for at least three years."

---

Speech is silver, silence is golden, giggling is brazen and laughter is apt to be ironical.

# The Determination of the Best Oils for Lubrication*

## Properties of Different Oils—The Several Tests to Determine the Various Qualities of Any Oil—Instruments Used for Testing Viscosity.

I do not propose to discuss to-night mechanical means of lubrication nor graphites. The subject is really oils and I will treat it from a chemist's point of view.

An ideal way, I presume, of testing the relative values of oils or lubricants, would be the following:

A bearing would first be examined to see if it was in good mechanical condition. Then we would have the shafting equipped with some means of measuring the power that was transmitted One test is the electrical, using dynamo and motors or some other means may be employed. Having the bearing ready, we use as a lubricant one of the oils to be tested. We would have to let the bearing run for considerable time before we would get the necessary information from our experiment, because, as you all know, certain oils will, after they have been in service some time, begin to gum, but this may not develop for three or four days. Then we have to take into consideration how the oil affects the bearing. Some oils may be excellent at the beginning but corrode at the end of two or three weeks. It is a hard matter to make a proper test, and tests of bearings equipped with dynamometers and involving these examinations are consequently only made at intervals by large consumers and often they are forced to employ other methods.

I am going to take up several methods used in testing oils and I shall discuss them under a number of heads.

There are three classes of oils (1) animal, such as whale oil; (2) vegetable as palm, olive, castor and cotton seed oil, and (3) mineral oil, including oils derived from petroleum by distillation.

There is one chemical property which oils possess, which enables us to distinguish vegetable from mineral oils. In order to illustrate I take a sample of mineral oil, add some lye, Gillett's lye will do, heat it and there is no change whatever. I repeat the experiment using a vegetable oil and you will note the oil becomes white, with a foam on top. All oils of vegetable and animal origin you will find become soapy. This is a simple test.

### Test for Grit.

The first point in my mind, and one which, perhaps is easy to settle, is the presence of dirt or grit in oil. This is not as simple a matter as one might think, because some oils which I have myself examined, are smooth, and apparently clean, yet when they are carefully tested, considerable grit is found.

This test may be made in an easy fashion. All you need to do is to take a small sample of oil, say one half wine glass full, and then add gasolene until it becomes quite fluid. You then take this solution of oil and filter it through a filtering paper, or ordinary blotting paper will do as well. You simply curl the filtering paper into a sort of cone and let the gasolene run into some vessel below. After this is run through, it is well to add a little more gasolene, and then wash out the oil which sticks to the paper, and then you have a record of the material which has been retained.

If there is any appreciable amount of dirt you will find it on the filter paper. It is easy to apply and you can very often settle, in the course of a few minutes, whether some samples are cleaner than others. The first test then is to satisfy ourselves that the oil is free from mechanical impurities.

### Test for Gumming.

The second point which I wish to take up is the problem of gumming, and this is easy to settle. Take a small flat dish or saucer and pour into this dish a quantity of oil. Allow it to stand in a warm place for, perhaps a week. A good place in ordinary practice, is on top of a boiler.

At the end of that time lift the oil down and examine it carefully. There should be no scum on top. Oils that gum do so because they absorb from the air oxygen. In the words of the chemist it oxidizes. Linseed oil dries or oxidizes and a good lubricant does not.

### Flash Point Test.

In the examination of oils we must always remember to take into account the purpose for which they are going to be used. With oils which are to be used for outdoor work, the question of speed is a minor one, but for work in the engine room where high speed machinery is used, the question of safety is one of importance. When we are using oils in-doors, we must take into account the temperature, at which the oil gives off vapor. I may say the chief insistence on this point is made by the Insurance Underwriters.

This test is probably familiar to you all, and is called the flash point test It may be carried out by anyone of you with an apparatus which you can buy for a small price. The chemist uses for this purpose a small porcelain dish which he calls a crucible; a tin dish or metal dish will answer quite as well. Then you get a sheet of asbestos, cut a hole in the asbestos so that the crucible can rest in it, then you make a brass cover with two holes in it. One of the holes should be large enough to admit a thermometer, and the other should be about one-half inch diameter. So far these materials will not cost you anything practically, but the most important thing you require is a thermometer and it is, I am sorry to say, somewhat expensive, as you have to buy something a little better than the ordinary article. It is a high temperature thermometer filled with mercury, and with this instrument, temperatures can be measured up to 550 degrees centigrade, which is somewhere in the neighborhood of 1 000 degrees Fahr. and costs about $1. A thermometer reading 400 degrees centigrade is quite ample for testing these oils, however. You can have any sort of stand on which to set up this apparatus.

The crucible is filled up with oil to about one-half inch from the top. You then put the metal cover on. Next you need heat. The best thing you can use for this purpose is a Bunsen burner. Your crucible is heated by means of this lamp.

There is one important point which you must not forget: that is, if you heat this oil too quickly, say in a minute, there will not be time enough for it to give off sufficient inflammable liquid to be detected. If you heat it very slowly, say taking four or five days, the inflammable vapor will leak away. Heat it so that the temperature rises about 15 degrees per minute. It is not difficult with a little practice to do this. You find as the oil gets hotter you will have to turn the flame of the burner down a little more. When the oil begins to get up to about 200 degrees centigrade, when you are working with engine oil, remove the cover from one of the holes in the lid and pass a match or taper across the opening, and

*Illustrated lecture before Toronto No. 1 Lodge C.A.S.E., March 19, 1909, by Prof. Bain, of Toronto University.

at every five degrees rise you repeat that practice.

At one temperature you will notice there is a little puff of flame, and then you immediately read your thermometer, That point is called the flash point, and this is the temperature at which the oil gives off the explosive vapor. It would be dangerous in large quantities. Underwriters are fairly unanimous in calling for a temperature of 350 degrees Fahr., or about 200 degrees centigrade. If the oil flashes above that point you may rest assured it is quite safe for indoor use. An oil that flashes below that point, however, you suspect. A low flash point almost always denotes that the oil has been adulterated by the addition of some more volatile lower grade material.

You remove the cover entirely now and continue the heating, passing the taper across the surface of the oil until finally the whole of the oil takes fire. That is the fire point. You may often find this mentioned in the specifications for oils. The fire point is not of such value as the flash point.

### Test for Acidity.

This subject is rather hard to treat here because the services of a chemist are employed to determine the corrosive action of oil upon bearings. Perhaps you may know about the test with blue litmus paper which turns red in the presence of acids. This is, however, of practically no value in the case of oils. If your bearings are very badly corroded have your oil examined by a chemist.

If the oil is blended, the test has less value as all of the vegetable and animal oils are acid in character. Here again we find that most specifications are very rigid. The acidity which is present usually in animal and vegetable oils, is due to a constituent which we call oleic acid. It is present in considerable quantities in tallow. Most specifications call for oil which has no more than four per cent. of oleic acid. I cannot say much more about this.

The chemist first makes up a standard liquid by means of which he can determine the quantity of acid which is present. He then takes a sample of oil, perhaps two ounces, and he shakes this up with pure alcohol. The alcohol must be entirely free of acids. Then he adds to the alcohol a small quantity of phenolphthalein which we call an indicator. It is clear when acids are present and red in the presence of alkali. One-tenth of 1 per cent. acid is sometimes found in good oil. If 1 per cent. acid, reject the oil.

### Viscosity.

Having settled the acidity of the oil, we come to the fifth and most important property of all. You know from your experience that if you have a bearing carrying a heavy load and running slowly, you use a very stiff lubricant. If you have a shaft running at high speed you use a thin oil. Now the chemists call the property which makes the difference between the thin oil and the heavy oil, the viscosity of the oil. Therefore, one of the things which a chemist has to find out is the viscosity of the oils submitted to him. Now, in order to do that, he makes use of an apparatus which determines the slowness of the flowing of an oil. Thin oil will pour out like water.

These investigations on the viscosity of oils are made with a number of different instruments. There are probably about twenty different instruments in use in different parts of the world for measuring this property. It is a hard matter, therefore, to get comparative results as each large consumer specifies that the oil must be measured in a certain machine.

There are two machines which are used in England and Germany. I have brought these two down to-night to show you what they are like. The Engler machine is used in Germany. You can regulate the temperature quite easily with this machine. In all viscosity measurements the temperature is a very important factor. You must keep the temperature the same. Supposing the temperature is 60 Fahr., you allow the oil t run into a glass vessel on which is etched off 50 cubic centimeters. We have a stop watch in our hand and we watch the oil filling into the lower vessel, and when it comes to the mark on the glass we stop the watch. The number of seconds which this quantity of oil takes to flow out gives you an idea of the viscosity or stiffness. Then if we take another sample and do the same thing, we find out the comparative values of each oil.

### Redwood Machine.

The Redwood machine is mostly used in Great Britain. The Admiralty test all their oils with this instrument. The important point about this machine is the orifice which you will find to be a piece of agate with a hole drilled through which the oil flows. This hole is carefully drilled and is of standard dimensions. Like the German instrument, it is tested, and if you wish you can get a certificate stating the dimensions. The upper surface of this little piece of agate has been made hemispherical and it is closed with a metal ball hung on a wire; the operation is the same as with the German instrument. Thermometers are placed both inside and out.

A simple way to test is by a pipette and note the temperature and the time it takes for a given quantity of oil to flow out. This method can be used by all and has been adopted by the Pennsylvania Railroad.

The viscosity of the oil is a difficult question for the reason that we have got to find out by actual experience after all what viscosity is the best for our particular machinery. If you have got an oil which gives good results, then when you are buying more oil, try to buy an oil which has the same viscosity as the oil which you have been using, providing the price is satisfactory. There are two sides to this subject of viscosity. A very thin oil when it is applied to bearings, will form a film which is so thin that it can be squeezed out readily, therefore, it is of little value; a heavy oil causes a loss in power by internal friction.

### Adulteration.

There are cases known in which very poor oils have been passed off on customers by adulterating same. If you take lye and boil it with vegetable oil, you will find it becomes soapy, as I have previously illustrated. You can, therefore, see that a low grade fluid oil may be transformed into a viscous oil by the addition of liquid soap. This adulteration would pass unnoticed in most cases. These oils gum badly and are unsatisfactory.

I have never heard of an instance of adulteration in Toronto and I fancy the only places it is likely to occur is in large places like New York or London.

### Body of Oil.

There is another important feature to be noted in testing oil. It is what the engineer calls "body," and curiously enough, we find in two samples of oil quite a different behaviour in this connection. For example, you might notice that a lubricating oil sometimes seems to have difficulty in adhering to the bearing. It behaves as though the bearing was covered with water and could not adhere. Animal and vegetable oils are more oily than the mineral oils.

Mineral oil appears to be less valuable from a point of view of body, than the vegetable or animal oils, and for that reason the practice has grown up in later years of using blended oils that is 80 per cent. vegetable and animal oils and 20 per cent. mineral oil. I do not know of any way to discover this body but by practice. The only way to find out is to try it.

# A Warren Gas Engine and Gas Producer Instalation

## Unique Instalation at Works of The Wood Products Co., in which Fine Screenings of Charcoal are Used as Fuel—Description of Producer and Engine.

One of the economical points in regard to gas producer plants is the quality of fuel which may be used to generate gas. The Warren plant installed in the works of The Wood Products Co. by W. H. Oliver & Co., Toronto, is unique in this respect. The waste charcoal that would otherwise be a loss is turned into power, the generated gas driving a three cylinder 125 h.p. engine, direct connected to a Canadian General Electric generator and belt connected to a John Inglis triple acting pump.

Fig. 1.—General View of Works, Showing Dam in the Foreground.

Fig. 1 is a general view of the plant of The Wood Products Co. This is an entirely new plant for the destructive distillation of wood into alcohol, acetate of lime and charcoal. Birch, beech and maple, which have no timber value are used for wood distillation. For every cord of wood there is produced eight gallons of wood alcohol, 200 lbs. of commercial lime acetate and 52 bushels of charcoal.

The whole plant is designed and arranged to secure economy. The layout will be seen in Fig. 2. Reinforced concrete has been used throughout for framework, roofs and floors with sand-lime brick curtain walls. The group of structures comprise four buildings, oven house, charcoal house, still house and power house, a plan of the engine room being shown in Fig. 3.

A concrete dam 214 ft. long has been built across the Burnt River to ensure a water supply throughout the year. This dam is shown in the foreground of Fig. 1. This view shows also a 50,000 gallon water tower which is 93 ft. high, both stand and tank being constructed of concrete.

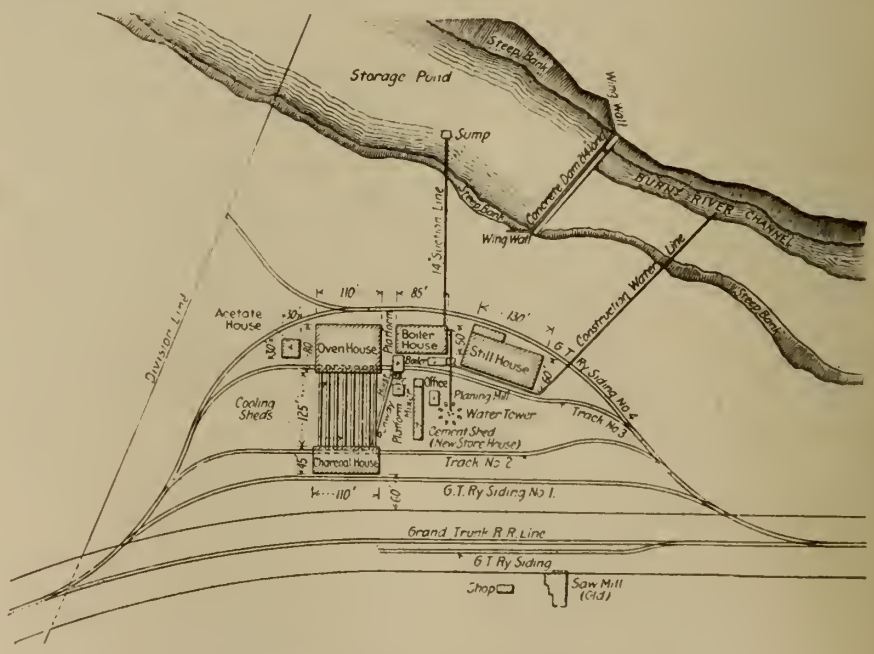



Fig. 2.—General Layout of the Wood Distillation Plant.

### The Boiler Room.

The boiler house is 52x90 ft., one story high, with a monitor roof. A battery of four 150 H.P. boilers, supplied by John Inglis, supplies the steam required for the plant. The fuel is the soft and refuse hard wood from the neighboring limits, also large quantities of marsh gas and wood tar driven off from the retorts during the destructive distillation process.

The tar is pumped from the still house and blown in under the boilers by a steam jet. All water is condensed, collected and used in the boiler again.

The boilers are located in the north end of the boiler house, large wood storage space is in front of the boilers and large openings are provided in the boiler house walls to pass the wood through. These openings are closed with rolling steel shutters.

### The Gas Producer.

At the side of the boiler-room is the power and producer gas room. The charcoal braise, the fuel used in the producer, is stored in a reinforced concrete bin at the side of the producer gas room, showed at A in Fig. 3. The producer is suction type.

The charcoal is fed automatically into the producer. The feed is regulated and if a greater amount than is required it is returned to the storage bin.

A pan shown at B, fig 4 contains water and generates steam. When the gas is produced it is led through C, fig 3, where there is a spray of water. This economizer contains a number of baffle plates and the sprayed water

drips from one to the other. The air is regulated by means of a damper in the bottom of C. The steam and air mix in the producer, go up through the fire, down an independent passage in economizer C, through a purge valve into D which contains coke and water which is sprayed in from the top. The top of D, for about two feet is filled with excelsior which removes the tar from the gas. A tar extractor is placed in the gas pipe between the producer and engine to remove any tar not taken out by the excelsior.

### The Engine Room.

The layout of the engine room is shown in Fig. 3. The equipment consists of the three cylinder 125 H.P. Warren gas engine and C. G. E. generator. John Englis 1,500 gallon pump, 1,000 gallon Blake pump, 18x10x20 and 70 R.P.M., supplied by R. H. Buchanan, Montreal, motor for running small Rand air compressor. A gasolene engine is also connected to the air compressor countershaft so that air pressure may be secured to start the engine. A one panel C. G. E. switchboard contains the necessary switches, D. C. voltmeter and D. C. ammeter.

### The Engine.

Fig. 4 gives a good view of the engine direct-connected to the generator. The engine and plant was made by Struthers Wells Co., Warren, Pa., and installed by their Canadian agents, W. H. Oliver & Co. The engine is a three cylinder one. On account of the continuous process in a wood products plant the engine must run without any stops. A valve may be removed and replaced in one cylinder while the other two carry on the work.

The cylinder wall of the engine is lubricated by a Warren force feed system. The main bearings and cam shaft bearings are ring oiling. The wrist pin bearing is lubricated through the medium of a tube, fitted with a ball check valve. The tube on the downward stroke of the piston enters the oil receptacle and the oil is forced to the wrist pin bearing. The bearing is of ample size and adjustable.

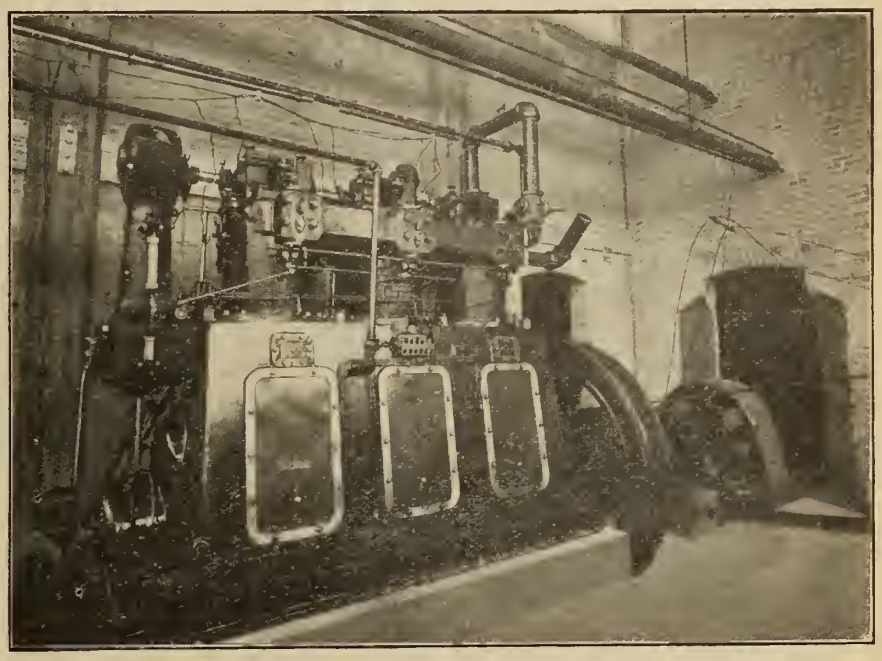


Fig. 4.—Warren Gas Engine Direct Connected to Generator.

The cylinder of the engine is designed to prevent any water leaking into the explosion chamber, yet it permits expansion of the inner wall without throwing any stress on the casting.

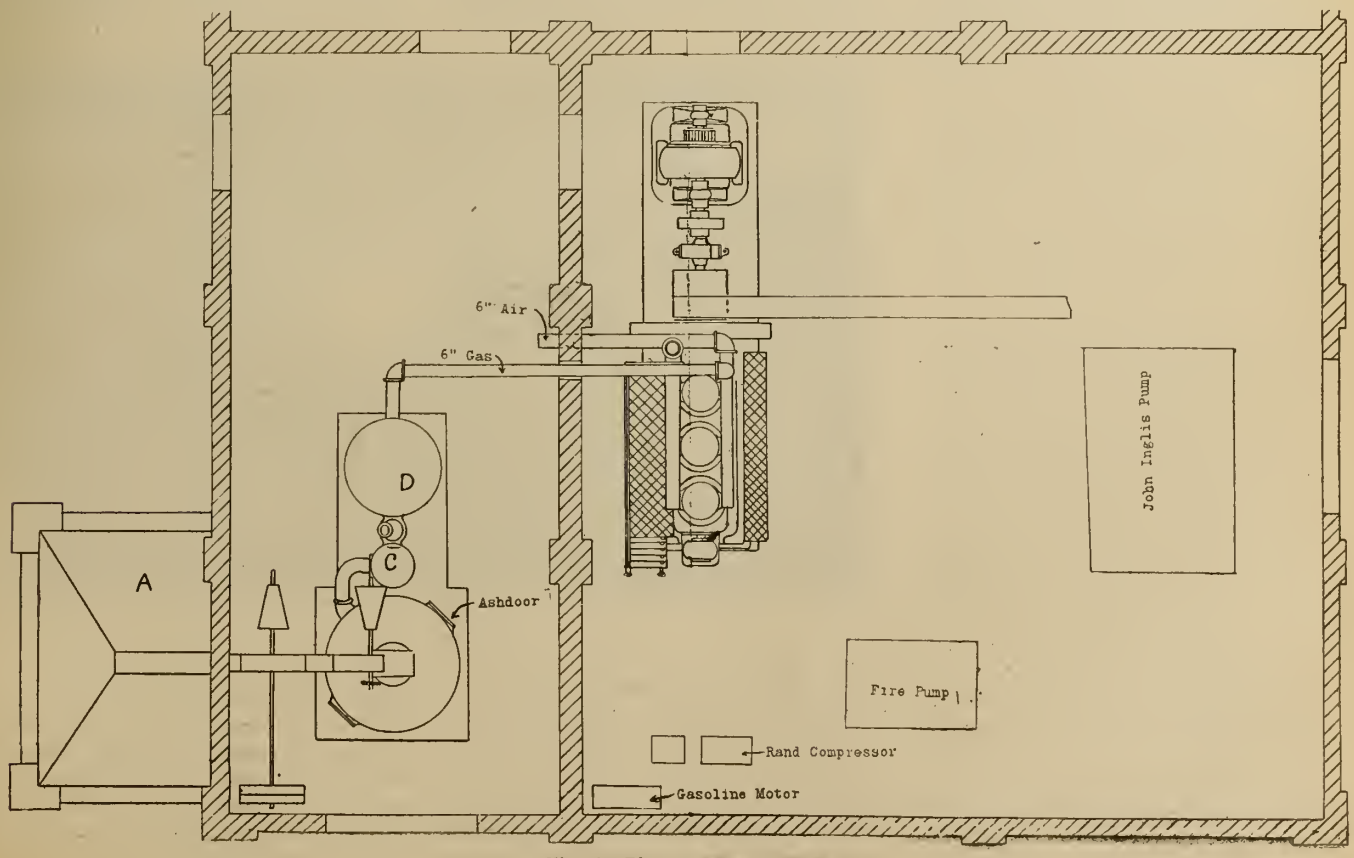



Fig. 3.—Plan of Power House.

The crankcase forms the outer wall of the water jacket at the lower portion of the cylinder, thus providing effectual cooling for the cylinder at the lowest portion of the stroke.

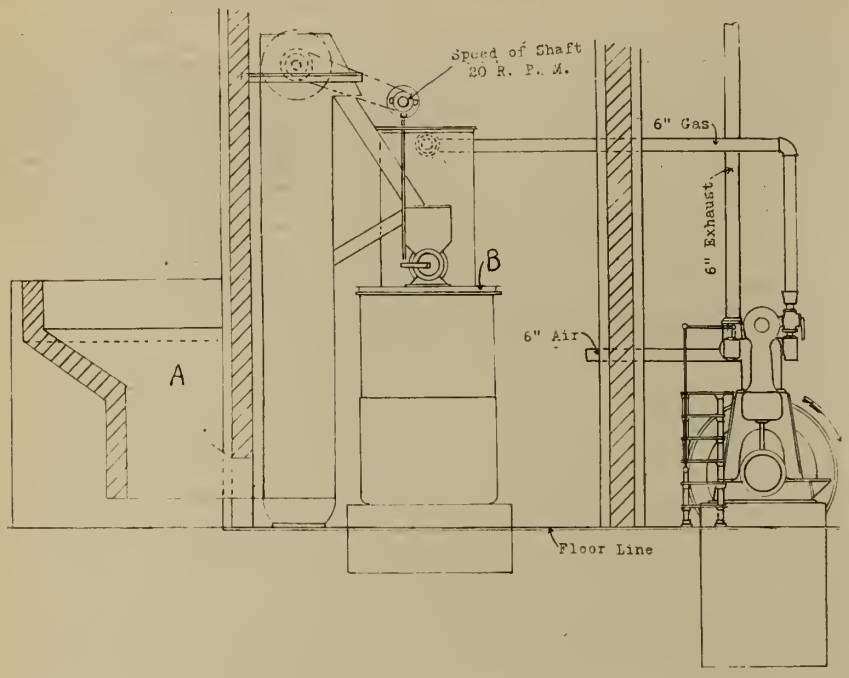



Fig. 5.—Elevation Showing Pipe Connections.

The point of ignition can be varied while the engine is operating. The method of governing and the construction of the valve cages, the location of the cam set on the top of the cylinder, where it is readily accessable, are features of up-to-date practice in gas engine design.

Fig. 6 is a view of the still house where the alcohol is distilled.

The whole plant including instalation of power equipment, and construction was carried on under the supervision of William H. Oliver, Toronto, with J. M. Wilson as assistant. Pitt & Co., Niagara Falls had the contract for the concrete work.

## EFFICIENCY OF WATER WHEELS.

Speaking of the methods employed in his practice Mr. Chas. T. Main, mill engineer and architect of Boston, states that: "Some tests of water wheels show a maximum efficiency of about 85 per cent. It is probable that over 80 per cent. is rarely realized in practice after wheels have been installed for a short time, and this is for three-quarters to full-gate opening. When the gate opening is less than about three-quarters, the efficiency begins to drop.

"After wheels have been run for some time the buckets and guides are not as smooth as when they are new, and the efficiency drops off. For these reasons I usually allow an average efficiency, for wheels running under ordinary conditions of age, repair, and variable gate opening, of about 75 per cent. Under exceptionally good conditions and where there are several wheels this could be increased."

## MIDLAND MARINE ENGINEERS

On Thursday, March 18, about fifty marine engineers assembled at the office of the Midland Engine Works Co., Midland, for the purpose of forming a council of the Marine Engineers of Canada, at this port. The project met with complete success, the new council being duly initiated and installed, Mr. Arthur Abbey, past president of No. 1 Council, Toronto, being present as Grand Council representative. The following staff of officers were elected and installed; President, Bruce Hanly; 1st vice-president Arthur Foote; 2nd vice-president, John Doran; secretary, John A. Murphy; assistant secretary, John A. Smith; conductor, Fred Chester; door-keeper, Jos Brooks; finance committee, Geo. MacDonald, Fred Chester and Ed. Hurl.

## PROBLEM IN FRICTION.

Replying to "Engineer" in your January number re "Problem in Friction," the "engineer" failed to mention the time in which he wished his weight moved, also the co-efficient of friction, so I have (in order to solve the problem) assumed these quantities. Therefore, the question stands thus: How many horse-power are required to move two ton up an inclined plane 60 ft. long having a rise of 17 in. in that distance the work to be done in one minute, co-efficiency of friction, .5? Solution, $4000 \times .5 = 2000$ lbs.

$$\text{Power} = \frac{F\,S}{T} = \frac{2000 \times 60}{1\text{ min.}} = 120{,}000$$

ft. lbs. per minute. Therefore $\frac{120{,}000}{33{,}000} =$ 3.63 h.p.

In solving the above the 17 in. raise is neglected. The high co-efficient (.5), however, will make up for the small power required to raise the weight 17 in.

Live Wire.

George T. Clark, Toronto, has been appointed city engineer of Saskatoon.

Fig. 6.—Interior View of Still House

The Gutta Percha Rubber Mfg. Co., Toronto, announce that the offices of president and treasurer made vacant by the death of Mr. H. D. Warren have been filled as follows: President, S. T. Warren (Mrs. H. D. Warren); Treasurer, Trumbull Warren.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## ENGLISH PRACTICE IN POWER DISTRIBUTION.

By T. Linton.

Canadian readers may be interested in the recent views of English engineers and experts on the subject of gearing for works and mills, which are described in the following article. The mill engine has always been a favorite subject for writers, but the mill and works gearing, including in the "gearing" all shafting, pulleys and fixings, as well as toothed wheels, has received comparatively little attention. The gearing has probably been overlooked as the engine is so very much more conspicuous and there is more of that personality about it, which all engineers like to think of as existing in their creations; the utility of the engine can also be more readily expressed in figures; something, too, must be allowed for the fact that the engine is the visible source of power; the gearing being comparatively passive, a mere agent of transmission. Whatever may be the cause, it remains true that the gearing deserves more attention than it has so far received.

Experience proves that in some English works the loss of power in the gearing is from fifty to one hundred per cent. more than in others; in some cases this great loss is due to unavoidable obstacles, to simple and direct power transmission, which are, however, absent in most other works. In the majority of cases the excessive loss is due either to a badly-designed scheme of gearing, to indifferent design of the details, or to the gearing not being in proper adjustment, or to all three. Old works are usually inferior in this respect to more modern ones. This is not so much due to carelessness or inferior workmanship on the part of the older millwrights as to the fact that the work is old and out of alignment, that brasses are in bad condition and the lubricating arrangements imperfect. Moreover, the use of toothed wheels for transmitting power very often led to awkward arrangements of shafting. In particular the upright shafts driving the main lines of shafting of the several floors through bevel gears were responsible for much loss of power.

A consideration of works gearing naturally falls under three heads. In the first place the general arrangement should be well thought out; secondly, the design of the details should be good; and thirdly, the workmanship, including the erection, should be first class. A great deal depends upon the general arrangement of the gearing. It is easy to spend money on needless complications and badly arranged transmissions, which do not produce any adequate return and which are indeed usually sources of loss of power and involve additional capital expenditure. These remarks apply more particularly to old mills in which rooms have not been arranged in relation to each other, with a view to economical power transmission. Probably the works have been extended from time to time and frequent rearrangements of machinery have necessitated corresponding rearrangements of the gearing. But with a natural desire to make use of existing arrangements so far as possible and prevented by the structural arrangements of the buildings from ever making a simple and efficient job of the gearing, the millwright has often achieved a final result anything but satisfactory. Even in quite modern English works this re-arrangement has often appreciably spoiled the scheme of gearing, although in a modern mill the arrangement of the gearing is generally so simple and also so universal in its adaptability that the effect of a re-arrangement of the machinery should not very seriously influence the gearing scheme.

The first condition aimed at by English engineers in a gearing scheme is directness. As far as possible intermediate shafting and gearing are avoided by them. Each constitutes a source of loss and although there are cases in which they are justifiable, such cases are generally exceptional. Intermediate shafts are like superfluous middlemen in business. Generally toothed wheels should be avoided and especially bevel wheels. It is true that when well made, with properly shaped and fitted teeth, and with the wheels and shafts firmly carried and accurately aligned, toothed gearing gives high efficiencies, although scarcely so high as a rope drive, unless the shafts are very close together or are inclined at an angle to each other. In practice these ideal conditions are seldom attained, and after a few years' working the adjustments are apt to be disturbed by the wear of brasses or the drying in of timber, beams or packings, with the result that the efficiency falls off seriously. With a rope drive such lack of adjustment does not affect the drive. The ropes form a very efficient flexible coupling, provided, of course, that the usual conditions necessary in rope drives have been complied with. Besides being comparatively inefficient, toothed gears are noisy and are scarcely so trustworthy as a rope drive. Not that the gears give out before the ropes, but they are more troublesome when replacement becomes necessary and are more apt to give out without previous warning.

In modern English cotton mills the drive is almost invariably by ropes from a pulley on the engine shaft to pulleys on the main lines of shafting as a rule only one line per room is directly driven from the engine, the other lines, when there are any, being driven from the former. The loss of efficiency due to this method as compared with the direct drive on to each individual shaft probably does not exceed two or three per cent. of the engine full load, and it simplifies the rope race. Indeed, the direct drive to each shaft is seldom possible in its entirety owing to the interference between the ropes and the rope race beams and shafts. In weaving sheds it is the usual practice to drive from the engine pulley by ropes to a second-motion shaft which passes across the ends of the cross shafts in the shed, driving them through bevel gears. This construction has been evolved because the shed is usually all on one floor and the lines of the shafting are too numerous to permit of satisfactory rope driving. The present arrangement could be modified so as to drive every third cross shaft by wheels from the second motion shaft, and to drive the others from the geared shafts by means of ropes. The improvement would be doubtful except as to noise, which would be reduced. In the old days in England the engine usually drove a second-motion shaft by means of spur wheels, the fly-wheel of the engine being the main spur wheel. The drive from the second motion shaft to the cross shafts of a shed was similar to that now in use, but in the case of works of two or more floors, the separate floors were usually driven by means of an upright shaft. These upright shafts were continually giving trouble, chiefly at the footstep bearing. Indeed, when the shaft and its wheels were very heavy as where a large works of several storeys had to be driven, the pressure on the

footstep rendered the ordinary means of lubrication ineffective and the only satisfactory method, which was, however, seldom adopted, was to supply oil under sufficient pressure to float the shaft. To a certain extent the jarring of the shaft by the action of the bevel wheels assisted the lubrication, but even at its best the upright shaft was unsatisfactory. The partial extinction of the toothed gear drive has been helped by the increased shafting speeds which are now usual. Toothed gears require a very firm and rigid support, or they will set up severe vibrations, which cause undue wear and sometimes breakage. Rigidity is never so necessary as when toothed gears are employed.

The simplest scheme of gearing is obtained when electric motors are used for driving the main lines of shafting, although a modern mill where the lines all run parallel with the engine crank shaft and are driven directly by ropes off the engine fly wheel is very little more complicated. Where the electrical drive is most advantageous (apart altogether from questions of economy or production) is in an old mill or works with ill-arranged rooms. An electric cable can convey current round the most awkward corners without any more loss than would occur in a straight length. Inasmuch as it is seldom necessary to run individual departments of many works alone, it is not usual to make provision for disconnecting the various lines from the rest, except by taking off the ropes, which, although a tedious process is so seldom necessary as to justify its adoption. Since the introduction of gas engines for works, however, it has sometimes been found desirable to relieve the engine of a part of its starting load and this is done by driving on to the main lines of shafting through one or more friction clutches. The use of these clutches is, of course, common enough in factories where individual lines of shafting or departments have to be stopped and recoupled while the rest of the factory is working.

---

## WHAT CAUSED THE HOT CRANK.

By One of the Boys.

A few years ago in a large shop engaged in engine building, boiler making, mill machinery, etc., the engine crank was showing signs of heating, one morning about seven thirty. It had been previously running all right. The engineer noticed it right on the start and turned on more oil through the centre oiler, as shutting down was entirely out of the question. As the crank still got hotter, he did the next best thing, reported to the shop engine builder who took charge of that hot crank, and thus the engineer got clear of it. Thus he had time to do his firing and other duties which demanded most of his time, with hurried glimpses at the engine. The engine builder put a man right on the job of watching that crank with hose in hand oil can near by. With oil and water they kept the engine going till noon.

At noon off came that crank box. It was brass of the usual type, lined with babbit or some similar box metal. Of course it was wiped (that is the lining) every way except the right, but as it was not too bad they scraped the boxes down to a lead fitting and were in high hopes of a successful run for the afternoon. But alas for hopes they had to get out the hose again and keep a man there as before. It was a long weary afternoon for those responsible for that engine's constant running.

At night off came that box again, a new set of liners were put in and leaded down to a perfect fit. Every body was confident the next morning and sure the trouble was over, but as Bobbie Burns says "The best laid plans o' mice and men gang aft agley." So in this case. The bearings warmed up right on the start and they had to get out the hose as before.

Flying water and oil made a wet floor and it was far from an ideal job to keep constant watch on that crank. At noon the scraping and loading was done as the day before, with no better results. The day dragged its weary length out unril the six o'clock whistle gave its welcome sound of release. After a hasty tea they took off the box. By that time they thought that the crank pin was out of true. On calipering it, they could not detect anything wrong with it. They were sure it was, so it was decided to knock it out of the crank and put in the lathe.

The pin had a thin hexagon nut on the inside end which was taken off and after some good heavy blows from an 18 lb. sledge, it was driven out and taken to a lathe. They had an expert machinist ready to true up that pin but it was as true as a die. Of course something had to be done so by taking turns at pulling the belt by hand the pin was returned, filed and polished. It was put back and a new set of liners fitted to the pin done in the best way possible, by careful leading and scraping. As the same fellows were at this job every night it was getting rather tiring towards morning.

The next day was no better. It was amusing to hear the remarks of those 400 or more shop hands. They told everybody and anybody except those who worked on that engine that they could fix it so quick it would make those fellows look foolish. Another case of bringing up children! No one can do that half so well as those who never had any to bring up. I beg your pardon for this digression, but it seemed to fit in so well and I just threw it in for what it is worth. The week wore on till Saturday quitting time. By this time the engine was out of line and most everything else. Off came cylinder head, out came piston and down came connecting rod. A line was carefully stretched and though it was hard to believe, that engine was perfectly in line. The look on the face of that engine builder was one of perfect amazement.

The superintendent up to this time had not taken any very active part, leaving it mostly to the boss engine builder. The superintendent said what do you suppose is the matter? The boss acknowledged he did not know. With that, the superintendent said to some helpers to pick up that rod (the connecting rod) the engine was an automatic 4-valve engine 18x42) and put it in the lathe. Then they found the rod bent at the small point near the crank end, nearly $\frac{3}{8}$ of an inch. That was straightened cold in the usual way, the engine all put together and as usual a trial run of a few minutes given it. It ran all right, so every body was happy for all thought the "hoodoo" was killed for good.

Monday the engine run in its old fashioned way just as cool as a cucumber, but by 7.30 Tuesday morning it was back to the old game of hot crank and the hose man was again attached. Before 12 o'clock the superintendent had men there ready to take the connecting rod off and put it in the lathe. It was bent as before about $\frac{1}{4}$ inch. They straightened it and put it back. There were some inquiries between the officials as to what could have bent that rod but no one had any answer except that old one, "I don't know."

By this time one of the helpers who had lost 30 hours sleep the week before and beginning to see a good prospect of loosing a lot more did some rapid thinking just then. He came to a conclusion very quickly and spoke his thoughts before the engineer, boss engine builder and superintendent, "I guess if we would remember that this is an engine and not a pump, that rod would not get bent." That was like a bolt from the sky. The engineer looked daggers and he said he did not use it for a pump, always worked out the water before he started, etc. However after this the rod did not bend any more nor has it done so since and as I have heard it has been running every day.

## A FEW HINTS ON FIRING.

By Thomas Downham.

Much has been said about different styles of firing. Some advocate thick fires, some thin, some the coking method, etc. The most economical method in my mind, is the alternative firing system.

It is a well known fact that thick volumes of smoke coming out of chimneys, indicate a great waste. What is the cause? You would answer incomplete combustion, and why? because there is not sufficient supply of superheated air, or oxygen, to mingle with the different bodies distilled off from the freshly fired coal by the heat in the fire-box.

If you let in a supply of cold air, by leaving the fire-box open a little, after each firing, you do a lot of harm in this way. You retard combustion by letting the cold air pass over the coal, instead of through the bed of fire, cool the boiler shell, and also form mon-oxide gas, by the cold air mixing with the volatile gases and hydro-carbons. It means this, then, that the more super-heated air, (up to a certain point) you get into the firebox, per shovel of coal fired, the better the results you are going to get. The best way to do this, is to fire one side at a time so that when you fire fresh coal on one side, you have abundance of super-heated air, flowing through the other side of the white hot fire, to mingle with the gases and carbons, to flash them into the right gas (di-oxide). If you fire all over the grate at one time, you stop this flow of hot air, and the result is poor combustion, and thick black smoke.

The fireman will find from experience how thick he can keep the fire to get the best results. On no account must the fire be kept so thin that air holes burn in it, (that is, the coal burns out in spots, and leaves patches of ash on grates, where cool air can flow through and give the same results as by leaving fire doors open).

The coking method consists of firing the coal all in front, and when it is coked, pushing it back on to the rear portion of the grates, so that you have a red hot fire in rear, and a green one in front. The great objection to this is that you have the fire doors open, twice as long as with the other system, having to open them to fire the coal, as well as while you are pushing the coked coal to the rear of the grates. Another objection is that when you are pushing it back with the rake, you suddenly release great volumes of gas and carbons, and the cold air rushing in, forms mon-oxide gas, and you only get about one-third the heating value of the fuel.

In a few words the right kind of firing then is:

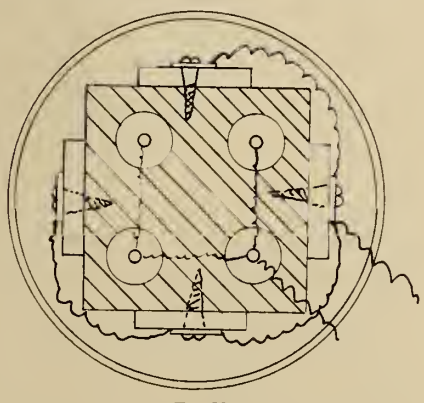
First—As thin a fire as you can keep without getting air holes in it.

Second—Firing one half of the grate surface at a time thinly, and as quickly as possible, so that you have abundance of super-heated air flowing through the other half, to flash the gases and carbons distilled off from freshly fired coal.

## HOME-MADE BATTERY.

By F. H. Chester.

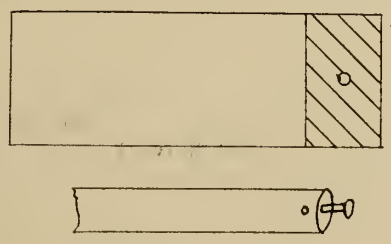
I had considerable difficulty at one time in getting batteries to supply current of sufficient strength to operate a set of bells placed at a distance from the batteries. I tried a home-made bat-



T p View

tery same as sketch, and was astonished at the results because it gave a strong current of about 12 amp. and an electro motive force of 1.9 volts.

The following is the formula for charging: ½-lb. saltpetre, 1 lb. of bichromate of potash, 9 pints of rain water, then add very slowly, stirring all the time, 1½ pints of commercial sulphuric



Carbon Plate and Zinc Rod.

acid. It will become warm when mixing, when cold it is ready for use.

Never put water into acid; always add acid to water.

When the battery is charged, always lift up zincs from solution when no work is expected from it, or the zinc will burn away without giving external work, and your battery will get heated and exhausted.

The sketch should need no further explanation but to make it clear. The ring shown is the top of a glass jar into which the other parts are placed. A pine block of wood is obtained about 1½ inches thick and the carbons are screwed to its four sides with the zincs let down through holes bored in the block.

Care must be taken that the carbons do not touch the bottom of the jar.

## BURNING DEBRIS FROM SEWAGE.

For a considerable period the Metropolitan Water and Sewage Commission of Massachusetts have followed the practice of compressing into blocks the material collected with their screens before the sewage enters the pumps and utilizing it for fuel beneath their boilers. They early learned, however, that the brick work was burned out very rapidly whenever this fuel was used in connection with externally fired boilers. On the other hand, it was found to have no effect upon the steel plates. As a result, internally fired boilers have been adopted.

In the recent instalation made at Deer Island, in accordance with plans by F. W. Dean, engineer, of Boston, a number of horizontal return tubular boilers were to be replaced by those of the internally fired type. Scotch boilers were adopted, the combustion chambers being made of steel plate with water spaces and without brick-work, except in the bridge walls and around the fire doors. All objectionable effect of the gases from the sludge was thereby avoided. The compactness and convenience of this type is shown by the fact that they met the requirements where there was insufficient room for vertical boilers, and where the locomotive type could not be used because of lack of space to remove and replace the tubes. But with the Scotch type the tubes could be drawn within the firing space of the boiler house.

## REVELSTOKE GAS PRODUCER PLANT.

In the March issue of The Power House, on page 16, was a description of a suction gas producer plant and Premier gas engine installed by the Canada Foundry Co., Toronto, at Revelstoke, B.C. The fuel used in the producer is a semi-anthracite. A test was recently made on this plant by J. Emslie Owen, an English expert. The results of the test are as follows:

Duration of test, six hours.
Total weight of fuel, 625 lbs.
Total indicated h.p. hours, 1, 12, 4, 5.
Mean indicated h.p. 187.3.
Coal per indicated h.p. 0.70 lbs.

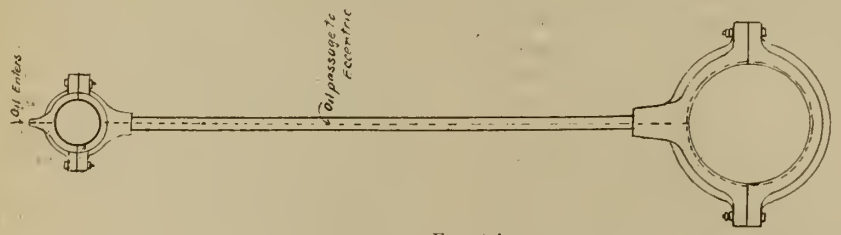
# Correspondence and Discussion on Previous Articles

Discussion is Welcome on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### ENGINE BRASSES.

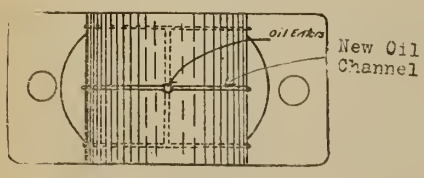
Your article on engine brasses has interested me very much, as we have had some trouble recently with a high-speed engine installed at the City Water Works. The trouble and solution might prove of interest to readers of Power House.

This city operates a mechanical filter plant in connection with the water supply. The water is raised from the river by two centrifugal pumps direct connected to high-speed vertical engines. The average total lift is thirty-nine ft., of which nineteen ft. is suction lift. The discharge of each filter unit is 290 gal. per minute, and it is therefore absolutely essential that each engine will be capable of discharging at certain speeds uniformly 290 gal. or a multiple of it as 580 or 870 gal. per minute.



Eccentric.

The first plan of operation tried was to operate one filter for twenty-four hours daily and to use the other units according to the demand, by throwing the second pump into operation. This forced one pump to operate continuously for an extended period at 460 r.p.m. The brasses of the eccentric straps wore away rapidly with this plan of operation. The next plan tried was to increase the speed of the engine to such a point that the pump would discharge sufficient water to supply two filter units or 580 gal. per minute. It was found that the daily supply could be pumped in 16 hours averagely this way. The eccentric brasses wore better this plan than with the first, but were far from satisfactory. All the time these bearings had been closely watched to see that they were getting sufficient oil which was apparently the case.



Top half of Upper Bearing.

By referring to Fig. 1 it is seen that the oil is fed from the top bearing through the rod to the eccentric straps.

Fig. 2 represents the top half of upper bearing, the point at which the oil enters is shown in the centre, from this it was conducted, as shown by the dotted lines of the drawing, and passed into the rod through a similar lower bearing or bottom half. It occurred to our engineers that these oil channels were rather shallow and were a more or less round about way of conducting the oil to the oil passage in the rod. As a remedy for this a deeper channel was cut from oil opening to oil opening, as shown by full line on Fig. 2. This was done over ten weeks ago and has demonstrated its value very clearly.

I offer as an explanation that these channels being so shallow and indirect, became temporarily choked, thus running the lower bearing dry for a certain period, and causing excessive wear of the eccentric straps.

A. K. GRUNMER.

---

### REPLIES TO INQUIRIES.

Engineer, Windsor.—The Hon. Mr. Duff says his bill respecting stationary engineers makes provision for the board of engineers to carry on their work of issuing certificates to Canadian engineers and to protect Canadians by stating that no certificates could be issued to men not British subjects, or who had not lived in Canada for three years.

Engineer, Elk Lake, Nipissing District, Ont.—Regarding the license law in Ontario. Will you kindly tell me where and how I can procure a license? Write to Mr. W. H. McGhie, Department of Agriculture, Toronto. He is the chairman of the board of examiners and will send you the necessary papers.

Engineer, Port Hope.—What effect would an increase in the lost motion of the valves of a Worthington duplex pump have on the admission of steam? Also what effect would a decrease have?

Ans.—The purpose of the lost motion is to delay the shifting of the valves to such an extent that one piston will nearly complete its stroke before its motion shifts the valve of the opposite side so as to start the other piston on its stroke. An increase in the lost motion would delay the shifting of the valves and cause each piston to begin its stroke relatively later with respect to the motion of the opposite piston. A decrease in the lost motion would have the opposite effect. Increasing the lost motion would also decrease the valve travel and the port opening while a decrease in the lost motion would increase the valve travel and the port opening.

Winnipeg.—The question is can we be incorporated and still belong to your society.—J. A. F. Yes. The C.A.S.E. was incorporated May, 1887, and have lodges in many parts of the Dominion.

Engineer, Berlin.—Q.—Why is it that some manufacturers in Berlin are allowed to run their plants with men who have no certificates while we have to pay for ours?

Ans.—I believe when the Government makes enquiry and finds that the law is being wilfully violated that steps will be taken to have matters of this kind properly adjusted. Every manufacturer should see that it is in their own interests to comply with the law. The Government has been notified of the parties not complying.

Engineer, Hamilton.—Ques.—Can a man who has only been in the country 5 (five) months previous to the 20th April, 1907, and who was not in charge of a steam plant of any kind at that time be entitled to a certificate without first undergoing an examination?

Ans.—According to the Act I think he should be examined before the board of examiners. If as you say that he has received his certificate, the blame would lie with the employer who said that this man had been in his employ at that time and in actual charge of a steam plant. It is hard for the examiners to know these facts when their guidance is the application form provided by the Department of Agriculture.

Engineer, Burlington.—Ques.—Please tell me how to find the length of the

piston rod of a vertical engine the connecting rod being finished.

Ans.—We take it for granted that the engine is all built with the exception of the piston rod and that you wish to know the correct length to make the rod. Connect up the crank connecting-rod, and crosshead and put the crank on its upper or headcentre. Measure the distance from some point on the crosshead from which a corresponding point on the piston rod can be conveniently located to the inner surface of the upper cylinder head. From this measurement subtract the piston clearance; the remainder will be the length of the piston rod from the point chosen on the crosshead to the upper surface of the piston. By adding to this length the amounts required for connection to crosshead and piston the total length of rod will be found. It would be as well to make a similar measurement from the point on the crosshead to the upper surface of the lower cylinder head when the crank is on its lower centre. The piston clearance plus the thickness of the piston added to this measurement should give the same length as was obtained when the piston clearance was subtracted from the first measurement.

W. A. CROCKETT,
Executive Secretary C.A.S.E.

## PRESSURE, AND ENGINE BRASSES

On page 28 of the March issue of The Power House I notice a question by Wm. J. Marshall. He asks for the gauge pressure between each of the three pumps in the arrangement he describes. The gauge between Nos. 1 and 2 will show 50 lbs. and the gauge between Nos. 2 and 3 will show 100 lbs. when the tank pressure is 150 lbs. Each pump commencing with No. 1 raises the pressure 50 lbs.

I also notice on page 26 of the same issue a letter from "Engineer-in-charge" dealing with some trouble he is having with his connecting-rod brasses. Perhaps the story of an experience I had along this line would be interesting. About a year ago I had some trouble with a hot crank-pin on one of my engines. Since the instalation of the engine over six years ago, the crank-pin has turned in the naked brass, and year after year as new machines were installed and the load increased to an overload, as at present, the bearing ran perfectly cool and gave no trouble.

One day while I was out of the room the oil-cup on the centrifugal crank-pin oiler became stopped up with foreign matter that had happened to get into the oil. When I returned to the room smoke was rising in great blue circles, while the dry bearing squealed. I grabbed my oil can and poured oil directly into the bulb on the stationary end of the pipe leading out to the crank-pin. That stopped the squealing and washed out the fine brass cuttings.

The superintendent is always welcome (?) in the engine-room when such things are going on, so in he marched and of course his first question was "What's up now?" I told him and explained that I thought I would let her run for awhile and that I might be able to bring her back without stopping. "No, better shut right down and turn the hose on her," he said.

"I've seen them come back after being pretty hot; cylinder oil will bring her," I continued.

"No, don't run her like that, you can cool her off in a minute with the hose and then maybe you can hold her," he persisted.

So I stopped and cooled the pin with the hose but in just 40 minutes it was as hot as ever in spite of both cylinder oil and graphite.

In order to finish the day I had to stop and use the hose four times, and when I shut down at night so much brass had been cut out that the engine was pounding furiously. After supper I came back and took the bearing apart, smoothed up the brasses and refitted them to the pin.

Next day it warmed a little on the start, but the cylinder oil finally conquered and by night it was running as cool as ever.

Next forenoon everything seemed al right, so I thought I would go back to engine oil again, but no sooner had the engine oil reached the pin than it started to squeal and before I could change back to cylinder oil it was quite hot. With the cylinder oil it soon cooled down again but after that it positively refused to run on engine oil. I tried changing from one oil to the other gradually but it was no use.

Now cylinder oil is such dirty stuff and thickens and thins so easily with the changing temperature of the room that I resolved to avoid its use by some means, so I had the brasses bored out larger than the pin and babbitted with the best babbitt that could be gotten (40 cents per lb.) and now that cranky crank wants nothing better than engine oil and runs cooler than it ever did.

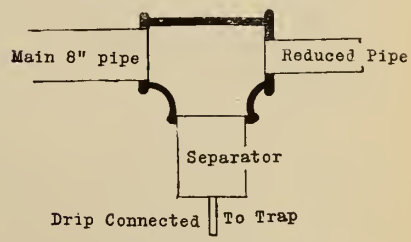
The babbitted brasses have been running 10 hours per day for a year now and during that time the wear has been taken up only three times. I never could find out exactly what spoiled those brasses but I think it must have been the cooling off so suddenly when they were excessively hot. However, give me now a good babbitt. I do not like to let my brasses butt together, first because it is a hard matter to file off just enough at each taking up of wear to give the right adjustment, and second, because if pasteboard liners are used up to about one-quarter of an inch in thickness they will compress and expand a little when you are keying up and a nice adjustment can be secured and yet the brasses hold firmly. I never let the liners touch the pin and I round off the edges of the babbitt at the liners so that the square edge will not scrape off the oil ahead of it.

"Overalls."

## PIPING PROBLEM.

We have a man in our factory who claims to be a marine engineer. He says a steam pipe with a dead end, I call it, is not dangerous, nor will it cause leaky joints. He claims that if the pipe is put together right, it will never be a source of trouble.

The reason the argument was brought up was this: In our main steam pipe which is about 120 ft. long there was no separator. I took the thing down and put a home-made one up because I



Piping Problem.

was getting so much water back through the engine, and we could not keep the joints tight. He went to the superintendent and told him, it is not an economical affair, and that the water in the pipes will do no harm. I claim it is and when the pull starts off the dead end of the pipe there is water hammer, which I think is very dangerous. I will give you a sketch of the separator I put up and would like comments from readers of The Power House.

R. A. McDONALD.

## WHAT TECHNICAL EDUCATION DOES.

Germany leads in techical education and as fast as her students are graduated, most of them with a very thorough engineering foundation, they are absorbed in the great iron and steel manufacturing plants of various kinds. It is these graduates who are giving Germany its strong position in the production of all kinds of iron and steel products.

# Large Engines for Municipal Pumping Stations

Description of Some Large Engines and Pumps Recently Completed or Under Construction for the Cities of Toronto and Edmonton.

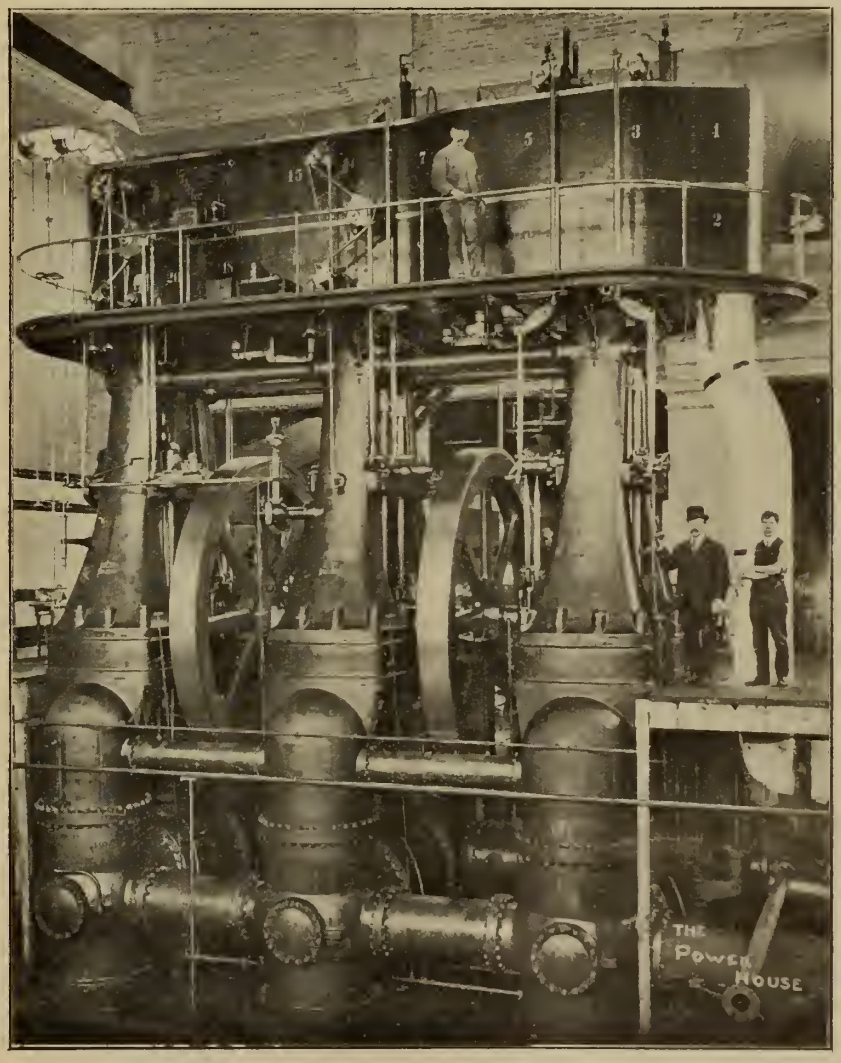
The large engine and pump illustrated in the accompanying half-tone has just been erected in Toronto's high-level pumping station, McMaster St. It is a self-contained vertical type triple expansion fly-wheel, three-plunger, single piston rod condensing engine. The engine was designed by the Holly Mfg. Co., Buffalo, the principal castings being made by the John McDougall Caledonia Iron Works, Montreal. All forgings were made by the Nova Scotia Steel and Iron Co.

The pump has a capacity of 6,000,000 gallons every twenty-four hours. The work done for every 1,000 lbs. commercially dry steam consumed by the engine in a 24-hour test.

The diameters of the cylinders are 17in., 31¼ in. and 48 in., with 36 in. stroke. The plunger is 21¾ in. single acting.

The high pressure cylinder is fitted with variable cut-off mechanism controlled by ball governor, driven by Morse chain. The pistons are fitted with Wheelock packing rings and the stuffing boxes with Holmes' metallic packing.

The crankshaft, crank and crosshead pin are hollow steel forgings. The connecting rods, cranks and plunger rods are open hearth forged steel and the crosshead is cast steel.




Six Million Gallon Pump and Engine.

engine works at a boiler pressure of 150 lbs., the diameter of the water supply main is 24 in., diameter of delivery main is 20 in. and pressure in the supply main is 15 lbs.

Water is pumped at a pressure of 75 lbs. and this is raised to 100 lbs. when necessary. There are 160,000 000 ft lbs.

The inlet valves on the high and intermediate pressure cylinders are the standard Corliss type. The exhaust valves on the high-pressure cylinder are Corliss. The inlet on the low-pressure and exhaust on both intermediate and low-pressure cylinders are poppet valves.

The cylinders are equipped with Richardson automatic sight-feed oil pumps. The bearings are equipped with sight feed oil cups.

### The Pump.

The pump is known as the direct flow type. The water always flows in one direction, there being no reversal of flow. The pump valves are 3⅝ in. diameter, mounted in groups in cages, the cages being secured to separate, vertical cast steel valve decks.

There are attached to the low pressure end a feed pump, an air compressor for charging the air chambers and an air pump. A Blake feed water heater, heats to within 3 deg. of exhaust steam.

The power plant is in charge of Thomas J. Walsh. H. E. Gibbs, of Holly Mfg. Co., Buffalo had charge of the construction and instalation. The testing engineer was E. G. Hill, Buffalo.

### The Inglis Engine and Pump.

Beside the engine and pump described above, is another 6,000,000-gallon pump, being erected by the John Inglis Co., Toronto, in the same pumping station. It was made to practically the same specifications. The height of engine and pump over all is 29 ft. 6 in. The cylinder diameters are 16, 30 and 40 in. with 36 in. stroke.

An engine and pump of 6,000,000-gallon capacity is being constructed by the John Inglis Co. for the City of Edmonton. Both the Inglis pumps mentioned are direct flow and when completed will be similar to the John McDongall engine already erected and shown in the illustration.

### Fifteen Million Pump.

Another pump in course of construction in the John Inglis works is a 15,000,000-gallon pump for Toronto's main pumping station, John St. The increasing requirements of the manufacturers and householders has made large extensions to the water service essential. This large engine has been under construction for some time and takes a year and a half to build.

It is a direct flow type. The cylinder diameters are 32, 60 and 90 in. with a 60-in. stroke. The height over all is 52 ft. The floor space covered is 16 ft. by 32 ft.

The pump cylinders for the 15,000,000-gallon pump were cast in the foundry of John Bertram, Dundas. The castings weigh 22 810 and 19,320 lbs. respectively. The steel for this engine, as well as the 6,000,000-gallon ones was furnished by the Nova Scotia Steel and Coal Co.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*

*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL - 232 McGill Street, Phone Main 1255
TORONTO - 10 Front Street East, Phone Main 2701
WINNIPEG, 511 Union Bank Bldg., Phone 3726, F. R. Munro
BRITISH COLUMBIA Vancouver, R. Bruce Bennett, 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C., Phone Central 12960, J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe, 933-935 Monadnock Block
NEW YORK - R. B. Huestis, 622-624 Tribune Bldg., Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas, 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf, Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II APRIL, 1909 No. 4

## RISKS FROM NON-LICENSED ENGINEERS.

As will be seen by reference to the department of correspondence, the Executive Secretary of the Canadian Association of Stationary Engineers has been receiving inquiries from licensed engineers in regard to companies employing engineers without a license.

The primary object of the passing of an act governing engineers was the safety of life and property and the government examinations are on that particular phase of steam engineering. Why companies will employ incompetent, or low-priced men who are not thoroughly acquainted with their business, or men who do not comply with an act for the public good, is beyond our comprehension. The companies are the ones who will be benefitted by a better service in the power house. They will also have the knowledge that their power plant is safe and in competent hands.

Clause II of the Act respecting stationary engineers reads as follows:

> Except as provided in section 5 of this Act, (that is, in case of the illness of the engineer with a certificate), every person who operates a steam plant as the engineer in charge thereof without the license or certificate required by this Act, and every person employing him or permitting him so to do shall be liable upon summary conviction to a penalty of not less than $10 nor more than $25 besides costs.

Companies must realize, and this is a point we wish to make, that the responsibility rests upon them in case of accident. We are not free to kill each other by employing incompetent men. Putting a man in charge of a steam plant, when he knows nothing about it, is like putting an ignorant man in possession of a bomb shell. No one knows just what the result will be, but be sure it will be disastrous. Why will a company take chances by employing a man who doesn't know his business?

If some companies are so neglectful of both life and property, a little pressure may make them realize that there are other companies and many people in Ontario who believe the Act respecting stationary engineers, to be legislation in the right direction. In Walkerville there have been three convictions with a fine of $10 and costs. There have also been convictions at Windsor and Chatham. If names of engineers operating without a license are sent to the Department of Agriculture, Parliament Buildings, Toronto, investigations will be made by the Board of Examiners and the name of the informant will not be disclosed.

There have been 5,573 applications from engineers to date and over 5,000 have been issued. The Board of Examiners have been kept busy examining applicants. There are still a few who have not complied with the regulations and these are being dealt with. Anyone wishing a copy of the act and regulations governing the same may obtain it by addressing the Department of Agriculture, Parliament Buildings, Toronto.

## TOPICS OF THE MONTH.

The Province of Manitoba had a Stationary Engineers' Bill before the House last session, but it was held over until next session. The bill is an exact copy of the Canadian act with amendments as printed in the December issue of The Power House, except that provision has been made for the grading of engineers into first, second and third class. It is a compliment to those who framed the Ontario act. Such an act is needed and there should be no hesitancy on the part of the members of Manitoba's legislature in making the bill law.

* * *

The late Aeneas McCharles has set aside a sum sufficient to provide a prize of $1,000 to the Canadian who does most to advance (1) the science of treating Canadian ores or minerals (2) the saving of life in connection with the use of electricity in supplying power and light and (3) of special meritorious scientific research. The prize is open to every Canadian, whether a self-trained man or a college graduate and should awaken a greater interest in the subjects of metallurgy and electricity.

* * *

There is a decided feeling among manufacturers that the duty on coal should be removed. In the west the United States must have British Columbia coal. During January the importation of Wellington coal into Seattle was between 10,000 and 12,000 tons. On every ton of this coal imported into United States territory duty of 67 cents a ton is paid.

"Had it not been for our heavy importations of coal from British Columbia," said Mr. Waterhouse, of Seattle, recently, "there would now be an acute fuel shortage in Seattle. We are putting out about 500 tons a day and you can see team after team leaving our bunkers while others are waiting."

Importing coal into Ontario and Quebec costs 53 cts. per ton which amounts to millions annually, thus increasing the cost of manufacturing. In Nova Scotia there is a tax on every ton of coal mined and this could probably be adjusted to help lessen the results of competition from United States coal. The removing of the duty will be of general benefit.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

## VALVE-INSERTING MACHINE.

The old adage that "Necessity is the mother of invention" is as true to-day as ever, and has been proved anew in the instance of the Hoefer valve-inserting machine, the necessity of which was suggested by a water works superintendent, who felt the need of replacing some old valves in his water works system, as well as placing new valves.

This new machine with a simple, special valve as shown in cuts Figs. 1, 2, 3 and 4, furnishes a very reliable way of overcoming the difficulties of installing a valve and does it without shutting off the water.

The comparatively low cost of this machine brings it within the reach of any water works plant, where the shutting off of water from the customer is a great annoyance, and where danger from fire is great when water is shut off for the making of a cut to insert a valve, and the further necessity of installing new hydrants, or replacing the old ordinary, double nozzle hydrants with hydrants with steamer nozzles. This simple machine will appeal to the water works fraternity.

### Construction and Operation.

The object of this machine is to provide means for inserting valves into a pipe under pressure, and with a minimum interruption of the flow through the pipe.

The embodiment of this new device of inserting a valve into a pipe, comprises a sectional valve casing, which is permanently secured upon the pipe at the point where the valve is to be inserted. This casing consists of two sections, which are secured together fluid tight by means of bolts, and the ordinary valve dome carrying the valve mechanism. The two sections have semi-cylindrical flanges to embrace the pipe. A fluid tight connection between the casing and the pipe is obtained in the usual manner, with a lead caulked joint.

The pipe cutting mechanism is carried by a casing shown in Figs. 1, 2 and 3 which is temporarily attached to an open side of the valve casing in a fluid tight manner by bolts, so as to enclose the pipe cutting mechanism in the valve casing.

After the two sections of the valve casing are permanently secured upon the pipe and the saw casing with the saw mechanism temporarily secured to the open side of the valve, the saws are then properly set with the blades equally distant from the valve seats and operated until the blades have cut a seat into the pipe, insuring a proper start for the blade ; but before the cut is made through the wall of the pipe, the dome carrying the valve gates and stem is permanently bolted on the top of the two sections of the valve casing as shown in Figs. 2, 3 and 4.

Fig. 1.—First Operation, Val ve Inserting Machine.

Fig. 2.—Second Operation, Valve Inserting Machine.

The pipe cutting mechanism consists of two parallel saw frames connected together by cross pieces. To these saw frames are attached metal saw blades especially made for this purpose. The means for obtaining the reciprocating motion of the saws consists of a rocking shaft supported in stuffing boxes in the walls of the saw casing.

On this shaft is keyed a crank arm to which the saw frames are connected by means of a link. On this same shaft extended through the stuffing box, is attached a lever by means of which the saws are given the recipro-

Fig. 3.—Third Operation, Valve Inserting Machine.

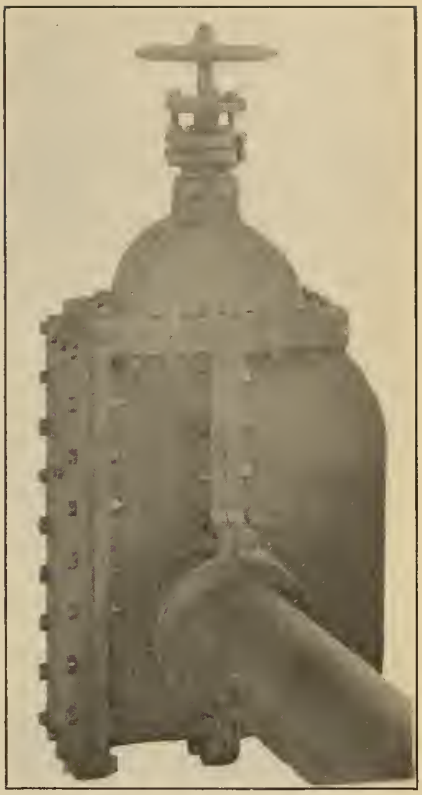


Fig. 4.—Complete Valve.

cating motion, and are fed through the pipe by means of an outside adjustable weight which transmits its pressure to the saw blades, through a shaft and arm, to which a roller is attached bearing upon the saw frame.

When the section of the pipe between the valve seats is cut off, it is withdrawn into the casing of the machine by swinging the operating lever downward as shown in cut Fig. 3.

As the saws cut through the pipe, the valve casing including saw casing fills with water. When the section has been cut out of the pipe and drawn

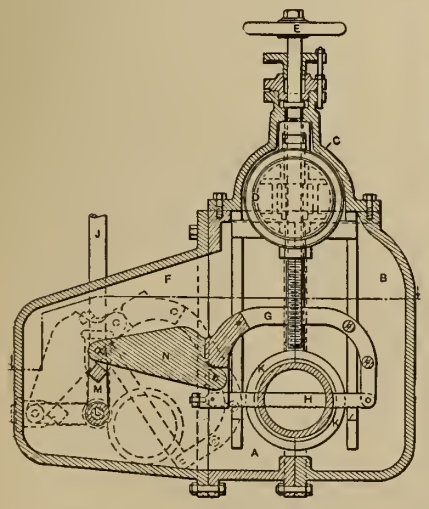


Fig. 5.—Mechanism of Valve Inserting Machine.

into the saw casing, the gates of the valve are then screwed down onto their seats thus shutting off the flow through the pipe. The valve and saw casings having been drained by opening the pet cock provided for this purpose; the water may thus be caught in a vessel and prevented from running into the trench to the great annoyance of the workmen. The saw casing with the mechanism is removed from the valve casing and a plate forming part of the valve casing is permanently bolted to the open side of the valve casing as illustrated in Fig. 4. It will be observed that the flow through the pipe is interrupted only while the machine is being removed and the plate substituted, an operation which consumes but a very few minutes.

This machine is not only useful for the insertion of valves, but can also be used in every day shop work, where it is necessary to cut pipe, in which case, one saw blade may be taken out and special pipe holders attached to the machine.

The valve-inserting machine is designed and manufactured by the Hoefer Mfg. Company, Freeport, Ill.

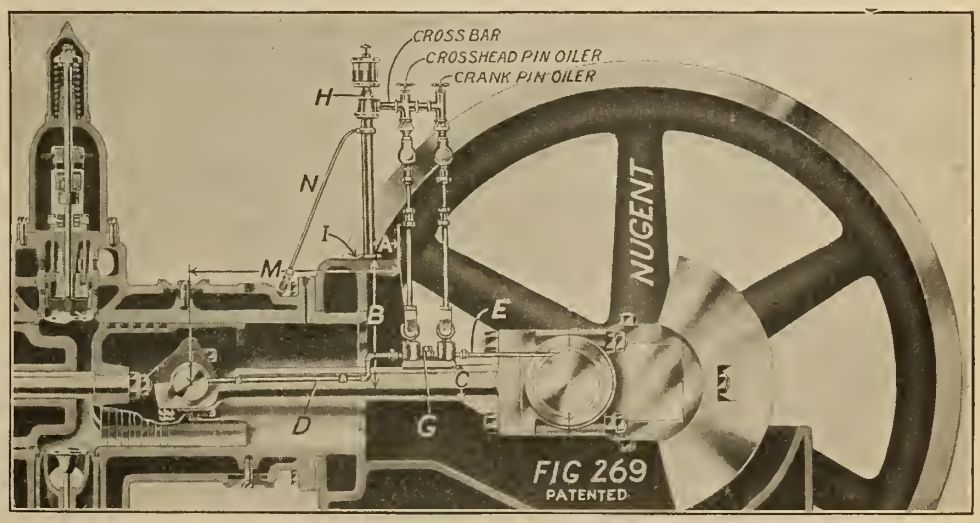



Fig. 1.—Telescopic Oiling Device for Horizontal Gas Engine.

## GAS ENGINE OILING DEVICE.

The accompanying illustrations represent new and patented devices, for oiling the crank and crosshead pins of a gas engine.

Fig. 1 is for horizontal gas engines.

and Fig. 2 is for vertical gas engines. The object of this design of an oiler is to provide a positive method for oiling these pins. It is accomplished by telescopic tubes which form a continuous conduit from a stationary supply of oil or oil cups to the crank and crosshead pins. The tubes telescope and are long enough to permit of a lap when the engine is at bottom centre. At K and J in Fig. 2 are ball check valves and stuffing boxes. These telescopic tubes are formed into a pump which forces the oil up to the crosshead pin and insures positive lubrication for this pin which is located up in the piston. The tubes and joints are made of hardened steel.

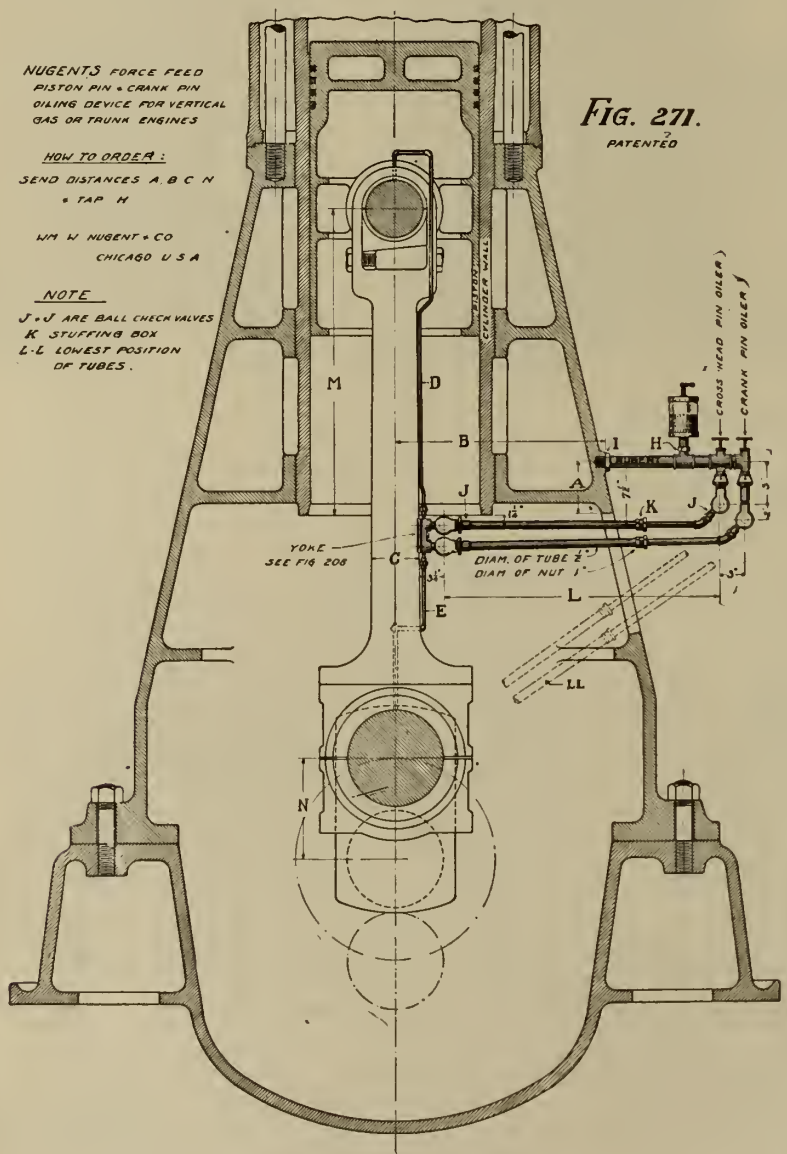



Fig. 2.—Telescopic Force Feed Crank and Crosshead Pin Oiling Device for Vertical Gas Engine.

The manufacturers have tested these devices on an engine running 500 R.P.M. and they give good satisfaction.

The oiling apparatus itself is self-lubricating and the joints are so arranged that they will not leak oil, so every drop that comes from the sight feed valve or oil cup is bound to go to the part to be oiled.

This device is manufactured by W. Nugent & Co., 18 to 30 W. Randolph St., Chicago.

## C. A. S. E. ANNUAL CONVENTION.

Preparations are being made to accommodate a large gathering at the 20th annual convention of the C.A.S.E. in London, July 27, 28 and 29. W. Norris, 47 Byron Ave., London, is chairman of the management committee, and active steps are being taken under his direction to make the 1909 annual convention a successful and beneficial gathering. Co-operating with the London Lodge, No. 30, is the London Ladies' Auxiliary, who have organized.

The London city council have granted the use of the city hall, which is in the centre of the city, for the exhibition. W. R. Stevert, of Jenkins Bros., Montreal, is president of the C.A.S.E. Exhibitors' Association.

## TORONTO ELECTRICAL ENGINEERS

Chas. F. Scott, consulting engineer for the Westinghouse Electric Manufacturing Co., gave an address before the Toronto section of that society at their meeting on March 19th. Mr. Scott discussed the developments of power transmission apparatus, touching first on the transformer, and outlining the different difficulties that had obstructed the progress of the designer as he attempted to enlarge it. Slides were shown illustrating the various methods used in increasing transformer capacity. Mr. Scott also showed interesting illustrations of both the earliest and the most modern alternators.

## BELLEVILLE ENGINEERS ORGANIZE.

Several progressive engineers around Belleville met Friday evening, April 2, for the purpose of organizing a branch of the Canadian Association of Stationary Engineers. All qualified stationary engineers are invited to take membership with them, and may receive applications by corresponding with the secretary, W. Cook, gas department. The object of this organization is to make better engineers, therefore all firms employing a member of this society have the satisfaction of knowing that he is striving to become a better engineer. All employers of engineers are at liberty to become honorary members.

## NEW FIRM OF ENGINEERS.

Messrs. Gagne & Jennings have opened offices in the Lawlor building, Toronto. They will attend to electric railway engineering, power developments, and industrial and architectural engineering.

Mr. Gagne, graduate of Toronto University, was engineer in charge of Toronto, Niagara Power Co., Niagara, St. Catharines & Toronto Ry. for two years, and Toronto, Niagara and Western Ry.

Mr. Jennings, son of late W. T. Jennings, is a graduate of R.M.C., Kingston, and McGill. He was employed on the Georgian Bay survey, and on the Niagara, St. Catharines & Toronto Ry.

## JUST SUITS HIM.

The MacLean Publishing Co., Ltd.,
Toronto, Ont.

Gentlemen :—

Enclosed please find Postal Note for $1.00 being my subscription to the "Power House" for 1909.

I like the paper fine, just what I have been looking for—a dollar paper along that line.

Yours truly,

F. J. RITCHIE.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Electricity and Steam.

The Thamesville Telephone Co., limited, has been incorporated with a capital of $10,000.

The Chalmers Company have been given the contract for the second unit of the Nelson power plant at a cost of $75,000.

The New Glasgow, N.S., Electric Light Co., is selling out to the Egerton Tram and Electric Company. The price named is $64,000.

The Cohalt Fire, Water and Light Committee have under consideration the construction of a municipal power plant for light and power supply.

The Eastern Electrical Engineering Co., Montreal, have been awarded the contract for the electric wiring of the low level pumping station at Point St. Charles.

A one hundred and fifty h.p. electric motor, recently installed at the Haileyhury waterworks, is now pumping the town's water supply at the rate of seven hundred and fifty gallons a minute.

C. F. Pretty has purchased the timber tract holdings of the Canadian Industrial Company, on the east coast of Vancouver Island, and proposes to install a power plant, pulp and saw mills.

Fraserville, Que., citizens are considering the question of remodeling the municipal electric light plant, and propose to install two water wheels and dynamos, with a total rating of 450 kw., with switchboard.

Kamloops, B.C., has decided on a three-phase water power system. Such a system would cost about $20,000. The Shuswap Power Co. asks to take over the present power plant and to sell power hy retail in the city.

The Wetaskiwin, Alta., city council has ordered a large electrical driven air compressor from the Westinghouse Co., at a cost of $2,700. This will he delivered at once and on its arrival a thorough test of the waterworks wells will he made.

Tenders will be taken shortly hy Smith, Kerry & Chace, Toronto, for the construction at Orangeville of the power house for the Dufferin Light & Power Company. The power house will contain three 150 k.w. hydraulic units with step-transformers to a transmission voltage of 22,000 volts.

Smith, Kerry & Chace, consulting engineers, Toronto, have awarded the following contracts in connection with the Seymour Power & Electric Company's new plant at Camphellford: Generators, Canadian General Electric Co.; transformers, Westinghouse Co.; water wheels, William Kennedy Co., Owen Sound.

K. L. Aitken, Toronto's electrical engineer, sent to Alexander Dow, city's consulting engineer, Detroit, the specifications for the conduit for the power distrihution plant from the Exhihition grounds to the Don south of Queen. The conduits will consist of twelve ducts and under, and the total will he 300,000 feet.

The general scheme for the reorganization of the Kamloops civic light and power department involves an expenditure of $16,500. This includes the purchase of a compound direct engine with a capacity of 150 K.W., costing $9,000, a 120 K.W. dynamo indirect $3,200, 150 h.p. hoiler at $2,100, new wiring $2,200, contingencies $1,000.

The B.C. Electric Railway Company has awarded the contract for 390 miles of aluminum wire which will be used for transmission purposes on the Chilliwack line. The tender of the Great Northern Aluminum Company, of Montreal, was accepted at $45,060. This company is a Canadian hranch of the Pittshurg Reduction Company, and has its works at Shawinigan, Que.

The tender of the H. D. Williamson Construction Co., Toronto, in connection with the construction of transmission lines hetween Point du Bois and Winnipeg was accepted. It amounts to $118,424, which includes $83,424 for the steel, gravel and cement required for the tower. Other tenders accepted were R. & D. McLeod, $23,421, for a telephone line, and the Stuart Machinery Company, $1,544 for repair shop equipment.

Contracts have been awarded by the Calgary Street Railway Co., as follows: Federal Electric Co., Montreal, aluminum, contract price, $4,500. The nearest competitor was the Northwest Electric Co., Edmonton, whose price was $50 lower. The Northwest Electric Company will furnish the overhead specials for $1,947.90. Wm. Stuart & Co., will supply the wooden poles needed for $3,400. Copper honds will he supplied hy the Canadian General Electric Co., Peterhorough, Ont., for $5,070.

City Engineer Bell has completed all the plans for St. Thomas ordered to be prepared hy Chief Engineer Sotham, of the Hydro Electric Commission. There are six plans altogether. One shows the grounds and location of the L. H. & P. plant on a small scale; another the engine room on a larger scale; a third, the city lighting circuit, showing all arc lights and gas lamps; fourth, the power circuit, with all users and amount of horse power; fifth, the fncandescent or alternating light circuit, amount used and size of transformers; sixth, the telegraph and telephone line, also the street railway line.

In a recent statement Frederic Nicholls, of the Canadian General Electric Co., Peterhorough, is quoted as follows: "This company has secured more new business during the past two months than during the preceding six months, and we have more enquiries on our hooks than we have had since 1906, and are, therefore, looking to the future with confidence." This is of special interest to Peterhorough, their shops there having suffered with other industries from the conditions of the past year. The company secured the contract let hy the Hydro-Electric Commission for the equipment of twelve stations on the transmission line. The commencement of this work will mean a renewal of the activities of the works.

Another power company has been formed to develop a waterfall for the purpose of supplying power to the mines of the Cohalt district. The new company's name is the Mines Power Company and its capitalization is $3,000,000. The falls that will he developed are on the Matabictchewon River near the mouth of the Montreal River. There is a drop of 320 feet in 800 feet and the company expect to furnish 10,000 horse-power. Surveys have been under way for the past few weeks under the direction of J. B. McCarthy, C.E., who has heen until recently engaged as chief engineer of the T. & N. O. Railway. The company will deliver power into the Cobalt camp hy the end of the year and their prices will interest all power users on account of the price, which will be exceptionally cheap. An office of the company is to he opened in Cohalt in the course of a few days and this end will be looked after by E. A. Wallberg, C.E., the well known gtneral contractor, who will also huild the entire plant with his own force of men.

### Trade Notes.

The switchboard and panels for the new Y.M.C.A. building, Ottawa, are being supplied by the Hill Electric Switch & Mfg. Co., 1560 St. Lawrence St., Montreal.

Peiler and Mackenzie, 52 St. James St., Montreal, have been appointed special general sales agents for Bunty steam traps and separators for the Maritime Provinces and Newfoundland. They are opening a hranch office in Moncton, N.B., to facilitate the handling of their eastern husiness.

Messrs. Laurie & Lamb, Montreal, Canadian agents for Messrs. Belliss & Morcom, Birmingham, England, have recently rceeived an order from the Toronto University for a Belliss engine for use in the hydraulic laboratory of the university. This engine will operate a couple of contrifugal pumps hy belt.

Messrs. Laurie & Lamh, engineers, of Montreal, advise us that they placed with Messrs. Belliss & Morcom, of Birmingham, England, an order for two 150 K.W. Belliss engines for instalation at McGill University for their power plant. These engines will be direct connected to generators. They are of two crank compound type with a special expansion gear fitted so as to care for overloads, and still maintain economy of steam consumption.

### Canadian Westinghouse Annual Meeting

The fifth annual report of the Canadian Westinghouse Co. was presented at a meeting of the sharcholders in Hamilton, on March 30. The difficulties which heset the parent company did not affect the Canadian plant and the annual statement was regarded an excellent one. The receipts and expenditures up to Dec. 31, 1908, were given, showing net profits for the year 1908 of $320,377.36. During the year $57,352.00 was spent in addition to property, this including the extension to the air hrake department.

### Handsome Calendar.

The Allis-Chalmers-Bullock, Montreal, have fsued a handsome hanger. Above a calendar is an interesting picture, "The First Engineers." This picture was designed for the Allis-Chalmers-Bullock Co., the original heing painted by Arthur H. Hider, a well-known Canadian artist. It shows beavers at work and the theme is very appropriate as the Allis-Chalmers-Bullock Co. are also hydraulic engineers. The calendar is for twelve months dating from March 1909.

### Contract for Lock Machinery.

The William Hamilton Co., Peterborough, have received a contract from the Railway and Canals Dept. of the Dominion Government for the supply of lock machinery for seventy-four locks.

It includes the supplying of all the operating machinery, anchorage fittings and pivots for twenty-four locks made up of the following: Two at Trenton, three at Glen Miller, one at Frankfort, five at Glen Ross, one at Raney Falls, one at Camphellford, three at Middle Falls, one at Healey's Falls, one at Hastings, one at Rosedale, one at Lindsay, three at Holland's Landing, and one at Newmarket. The contract amounts to about $100,000 with extras.

---

### CATALOGUES.

MOTORS—Bulletin 1068 of D.C. motors, constant, varying and adjustahle speed with their application to machine tools from the Canadian Westinghouse Co., Hamilton.

BOILERS—Illustrated catalogue from the Lyons High Pressure Steam Boiler Co., 16 Pearl St., Toronto, fully illustrating and describing the hoilers, pointing out the prominent features of the Lyons make. The method of manufacture is described and all parts are taken up separately. The action of the water in the boiler is also illustrated.

STEAM SEPARATOR—Catalogue of the Potter-Mesh Separator and Superheater, from the Ideal Steam Separator & Supply Co., 73 Adelaide St. East, Toronto, giving description and showing the application of the separator.

POWER PUMPS—The Goulds Pump Co., 513 Coristine Bldg., Montreal, have issued a neat catalogue of 32 pages in which are described and illustratsd Goulds' triplex power pumps. Pumps of different design are shown for hoiler feed, hydraulic elevators, mine pumping, general water supply, municipal water works, pulp grinders, fire service, water tanks, etc.

ARMATURES—Instruction hook No. 5026, from Canadian Westinghouse Co., Hamilton, giving instructions for repairing and rewinding Westinghouse railway type armatures.

SIGHT FEED OIL PUMP—Bulletin 209 from the Sight Feed Oil Pump Co., Milwaukee, Wis., describing the Richardson Automatic Sight Feed Oil Pump, model "M."

ELECTRIC PUMP GOVERNORS—Instruction pamphlet No. T 5042 from the Westinghouse Traction Brake Co., Pittshurg, describing the construction, operation, regulation and adjustment of electric pump governors.

BOILERS—Catalogue from the Lyons High Pressure Boiler Co., of Canada, 16 Pearl St., Toronto, pointing out the features of the Lyons boiler.

CONDENSING MACHINERY—Catalogue No. 74 from Dean Bros., Steam Pump Works, Indianapolis, Indiana, 56 pages, describing air pumps and jet condensers, vacuum pumps, with tahles of the various sizes included. A number of types are illustrated.

FAN MOTORS—Folder 4101, from the Westinghouse Co., Pittshurg, illustrating and describing fan motors for direct current.

FAN MOTORS—Catalogue for 1909 from Canadian Westinghouse, describing and illustrating direct and alternating desk, hracket, ceiling and column fans.

POWER EQUIPMENT—Circular from Laurie & Lamh, 211 Board of Trade Bldg., Montreal, describing the instalation of Belliss & Morcom engines in the Johanneshurg municipal power

station in South Africa. Six of this make of engine are installed, totalling 6,000 horse power.

STOKER—Illustrated catalogue from Paul L. Crowe, 47 Montgomery St., Jersey City, describing the universal stoker and chain grates. The application to boilers is illustrated and tests are given.

FIREBRICK—From Harbison-Walker Refractories Co., Pittsburg, Pa., illustrated catalogue for 1909, 158 pages, coated paper, gilt edges, leather bound. Silica, magnesia, chrome and fire clay brick and various refractories are fully described. The catalogue is well illustrated and the construction of fire brick linings in cupolas, boiler settings and various furnaces is shown. The catalogue will be sent to foundry foremen applying for it.

DRAWING MATERIALS—33rd. edition of catalogue from Keuffel & Esser Co., 540 pages, well illustrated. The general appearance of the catalogue has been much improved and it is well bound. An important change in the general arrangement of the catalogue has been made by creating a special section for "drafting office-furniture," which is now forming an important department among the goods manufactured. Many additions have been made to the catalogue making it very complete. It will be sent free to engineers and companies on request.

## BOOK REVIEWS.

LAW AND BUSINESS OF ENGINEERING WORK—162 pages, illustrated, by Charles Evan Fowler, C.E., published by McGraw Pub. Co., 239 West 39th. St., New York. Price $2.50 net.

The matter in the book is the result of a series of lectures delivered to the students of Washington University. In addition there are given forms of contracts, specifications and blank business forms which will be of advantage to both the engineer and the practical engineer.

There are ten chapters which treat very thoroughly the subjects, the relation between engineer and contractor, ordinary forms of contracts, ordinary specifications, special forms of specifications, special forms of contracts, inspection of engineering work, estimated materials and the cost of engineering structures, bidding on engineering work, organization of contract work and essentials of contract law.

# Power Supply Markets

## ST. JOHN, N.B.

Two car loads of contractors' equipment have arrived at Grand Falls, N.B., and work on the $5,000,000 power scheme described in March issue has commenced. Purchases of additional contractors' equipment, consisting of air compressors, electric motors, drills, tunneling machines, pumps, hoisting engine, derricks, concrete mixer, rock crushers, orange peel and clam shell buckets, sand scows, gasoline towboat, machine and blacksmith shop tools, &c., will shortly be made by Frank B. Gilbreth, 34 West Twenty-sixth street, New York, for constructing the hydro-electric plant on the St. John River, at Grand Falls, New Brunswick, for the Grand Falls Power Company. This equipment is to be purchased for the contractor's plant only. John B. McRae, of Ottawa, Canada, is the chief engineer, and Ralph Mershon, of New York, is electrical engineer.

## MONTREAL.

OILS—There is no change from our last report on the situation regarding lubricating oils. The demand has not fallen off, nor has it shown any perceptible increase. The current prices (April 9th), are as follows:

Cylinder oils, (imp. gal.) 60c. to 80c.; engine oils, 30c. to 60c.; machine and dynamo oils, 30c. to 45c.; shafting oils, 25c. to 40c.; lubricating greases, (per lb.) 8c. to 12c.

GASOLENE—The market is strong under a steady demand which has the tendency to increase. This is due to the fact that there is an increasing call for gasolene engines in the province. The movement in these engines is exceedingly brisk, especially in the smaller sizes from 1 to 5 horse power.

The approach of the automobile and motor boat season leads to the expectation of larger business in gasolene, but whether this will advance the price is a matter of conjecture. This depends entirely upon the relation of the existing supply on hand to the increased demand. The price at this date (April 9th), is 18½c. per gal., f.o.b. Montreal, cases $2.60.

STEAM SPECIALTIES—There has been a marked improvement in these lines and this bids fair to be permanent, the increase of March business over that of February being about 10 per cent., which is very encouraging. In this increase appears a satisfactory amount of new business resulting from the acceleration of the building trades. There is an increasing amount of inquiries and the percentage of orders placed is on the gain. It looks as though the nervousness of purchasers is becoming a thing of the past and increased confidence is evident all through the trade.

BOILER TUBES—Stock prices in these are steady but import prices on mill delivery are over the situation in Europe: "The condition with the tube industry who has recently been over the situation in Europe: "The condition of this business in Europe is very poor and in their anxiety to get orders the mills are cutting prices, particularly in the export trade. The German export prices are, in many cases, as much as 75 per cent. to 100 per cent. lower than for home consumption." Of course this is a case of dumping, but on account of there being no duty on boiler tubes there seems to be no way of preventing this, if it were desired. The consumers get the advantage of this and the ones to suffer are the jobbers, in decreased commissions. Thus, at this time the prices for mill deliveries are very much lower than stock prices. These latter will no doubt be depressed if the mills do not stop their price cutting tactics.

Stock prices are as follows:—2-in. tubes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

BELTING—The movement in this line is gaining strength and this fact can be directly traced to the loosening of the purse strings of manufacturers in replacing worn and patched up belts with new goods. Contemplated extensions are going forward and additions to power plants are underway, all tending to stimulate the demand in this line.

ENGINES—This line is not very active. Inquiries are numerous but the amount of business placed is small. However, owing to the increased resumption of manufacturing, the demand for engine accessories is steadily tending to increase.

## TORONTO.

"There is lots of business going and some of us will get it." This was the expression used by one representative of electrical machinery and it about expresses the situation in Toronto. There are a number of large manufacturing plants planned and there will be some brisk business in electrical lines.

The Canadian Westinghouse, Hamilton, held their annual meeting on March 31, and the fifth annual report was very satisfactory. Other electrical concerns also report business fair with prospects good.

The John Inglis Co., have a number of large contracts on hand including large pumps and engines for Toronto and Edmonton. The boiler business is the weakest of the power lines but the demand is better than at the first of the year.

Dealers in grates report some fine sales with a number of live inquiries which will develop into sales. Business, on the whole, is very good in power lines.

BOILER TUBES—No change in prices. The following prices are quoted per 100 feet: 2-in. $8.50 to $8.75; 2½-in., $10.50 to $10.75; 3-in., LEAD WOOL—$10.50 per 100 lbs., $200 per ton. $12.50; 3½-in., $15, and 4-in., $18 to $19.

FIRE BRICKS—Demand is good. English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000.

OILS—Prices are stationary. The demand has varied very little from the last report but if there has been any change it is an increase of sales during the month.

## WINNIPEG.

A large number of elevators are being contracted for at different points, many of them along the line of the G.T.P. Every elevator erected means a gasolene engine. A great number of Fairbanks Morse have been sold for elevators. A great number of gasolene motors will be required this year.

Considerable anxiety is being felt in many quarters at present, lest the unrest among the labor unions will culminate in strikes, and thus seriously impede the building proposals for the coming season.

There is a good demand for electrical machinery and there is a good demand for the smaller electrical goods such as fittings, electric wire, etc., as well. Trade for March is much in excess of trade for the same month last year, though collections have not been quite as good as in January and February.

LUBRICATING OILS—600 W. cylinders, 80c.; maple leaf cylinder, $1 per gal.; 700 A. cylinder, 75c.; Sterling cylinder, 59c. and 54c.; Solar red 50c.; Capital cylinder, 59c. and 54c.; Solar red engine, 32c.; Atlantic red engine, 29c.; Eldorado castor, heavy, 27c.; medium, 26c.; Ruddy harvester, 28c.; standard gas engine oil, 36c.; Renown engine oil, 38c.

PETROLEUM AND GASOLINE—Silver Star, in bbls., per gal., 20c.; Sunlight, 22c.; case, $2.45; Eocene, gal., 24c.; case, $2.60; Penniline, gal., 25c.; Silver Light, 22c.; Starlight, 20c.; Sterling Light, 24c. Engine gasoline, gal., 22½c.; f.o.b. Winnipeg, cases, $2.50.


ELECTRIC BARGAINS

2 H.P. A.C. Motor (C.G.E.)
10 " " " "
7½ " " " (Westinghouse)
30 " " " "
15 " D.C. " (Kay)
20 " " " "
7 " " " (Diehl)
175 Lt. " Generator (Eddy)

And Others — Write Us

We manufacture both A.C. and D.C. Motors and Dynamos for any output.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide West — Toronto, Ont.

Avoid Possible Trouble
by using only
HERCULES Seamless Copper FLOATS

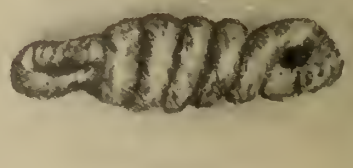
We guarantee them to be perfect in material and workmanship. 250,000 of them are giving satisfaction to-day.

Write for Catalog "C."

Hercules Float Works
P.O. Box 396. Springfield, Mass.

JOHN GARDE & CO.
142 Victoria Street — TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers

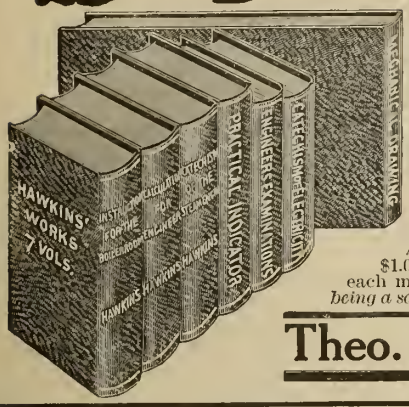


A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

*Hawkins Works*

# On Easy Payments.




Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

SPECIAL OFFER Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month (*when complete set is purchased the price is $12, being a saving of One Dollar*). **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

(X) HERE

| | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed ..... (*Firm Name*)

Home Address .....

# HARRIS

## Heavy Pressure Bearing

# METAL

**Is Perfection in BABBITT**

**If you have used IT, enough said** **If not, try IT and you will always buy IT**

## Get the Copper Coated Cake

**Manufactured by**

## The Canada Metal Co., Limited Toronto

## THAT LEAKING JOINT!!

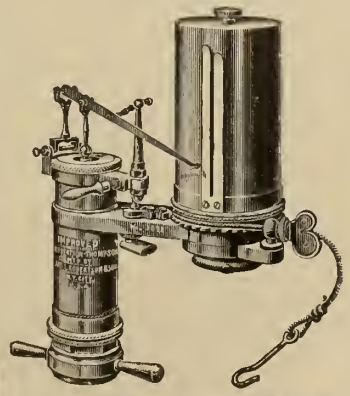
**HAWKINS' IMPERISHABLE JOINTING CEMENT**

used on any joint will stand super heat, moisture, acid or gas tests. The older it gets, the tighter it sets. A TRIAL TIN ON REQUEST to any responsible firm. If the cement does not make a perfect joint the unused portion may be returned and no charge will be made.

**BAIN & MITCHELL,** Y.M.C.A. Building, **MONTREAL**

Sole Canadian Agents for

W. T. HAWKINS & CO., HUDDERSFIELD, ENG.



**Jas. L. Robertson & Sons**
**38 Warren St., New York**

## Get in Touch

with your engine with a

**ROBERTSON-THOMPSON INDICATOR**

There's no easier—surer way to advance in position and salary than by making your engine run perfectly at lowest possible cost. Price moderate. Terms easy. The Willis Planimeter is a fine instrument.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boilers.

Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

## Boiler Compounds.

The "Skaleoff" Co., Montreal

## Castings, Brass.

Hercules Float Works, Springfield, Mass

## Combustion Recorder.

Canadian Instrument and Testing Co., Montreal.

## Condensers.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
De Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Galt & Smith, Toronto.
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Crank Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Jones & Moore Electric Co., Toronto.
Electrical Maintenance & Repair Co., Toronto.

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Electrical Maintenance & Repair Co., Toronto.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

H. W. Petrie, Toronto.

## Engines, Corliss.

Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.

## Engines, Gas and Gasoline.

Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Darling Bros., Montreal
Brownell Co., Dayton, Ohio
Goulds Pump Co., Montreal.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Gas Producer Plants.

Bain & Mitchell, Montreal
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Peiler & MacKenzie, Montreal

## Generators.

Allis-Chalmers-Bullock, Montreal
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Grates.

Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Peterboro Lubricator Mfg. Co., Peterboro

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lead Wool.

John Garde & Co., Toronto.

## Lubricators, Force Feed.

Darling Bros., Montreal
Sight Feed Oil Pump Co., Milwaukee, Wis

## Mechanical Stokers.

Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

## Meters, Water and Electric.

Peiler & MacKenzie, Montreal

## Mill Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Oilers, Gang.

Sight Feed Oil Pump Co., Milwaukee, Wis

## Oil Filters

Darling Bros., Montreal

## Panels, Electric

Hill Electric Switch Co., Montreal

## Pipe Threading Tools.

Borden-Canadian Co., Toronto.

## Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Power Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford.

## Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Pump Governors.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Pumps, Oil.

Sight Feed Oil Pump Co., Milwaukee, Wis

## Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Safes.

Goldie & McCulloch Co., Galt.

## Safety valves.

Peiler & MacKenzie, Montreal

## Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Shaking and Dumping Grates

Standard Engineering Co., Toronto

## Sight Feed Oil Pumps.

Sight Feed Oil Pump Co., Milwaukee, Wis

## Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

## Steam and Oil Separators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Steam Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Standard Engineering Co., Toronto
Waterous Engine Works Co., Brantford

## Steam Specialties.

Darling Bros., Montreal
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

## Steam Traps.

Darling Bros., Montreal
Standard Engineering Co., Toronto
Peiler & MacKenzie, Montreal

## Stocks and Dies.

Borden-Canadian Co., Toronto.

## Switches, Electric

Hill Electric Switch Co., Montreal

## Switchboards, Light and Power.

Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co., Montreal

## Tanks, Blow-off

Darling Bros., Montreal

## Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford

## Tests and Inspections.

Bain & Mitchell, Montreal

## Transmission Machinery.

Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

## Turbine Water Wheels.

Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

## Unions

Dart Union Co., Toronto

## Vacuum Regulating Valves.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Valve Reseating Machines

Darling Bros., Montreal

## Valves.

Kerr Engine Co., Walkerville, Ont.
Standard Engineering Co., Toronto.

## Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

## Watt Meters.

Gas & Electric Power Co., Toronto.

# One Moment Please

## Are You Obtaining the best Results From Your Boiler?

¶ You can get 100 cents worth of steam for every dollar's worth of fuel, providing your boiler is clean and in good condition.

¶ "SKALEOFF" will positively remove and prevent scale and will preserve the boiler and packing.

¶ "SKALEOFF" can be kept in the boiler as long as you may require to keep the boiler closed. There is no need of changing the water except when cleaning out the boilers.

¶ "SKALEOFF" does not contain any strong corroding ingredients, such as acid-salts, caustics, slacked lime, soda ash, etc.

¶ "SKALEOFF" positively will not eat packing or scratch the various engine or pump rods, it will not ruin valves or joints, it will not cause a leaky boiler either at a seam, joint or rivet.

¶ We will be pleased to furnish, free of charge, enough "SKALEOFF" to make a thorough test.

¶ There is satisfaction in every barrel and our guarantee goes with every barrel you get.

¶ *Send for particulars and have a free test made in your own boilers under your own conditions. Don't take our "say so" let us SHOW you.*

## The "SKALEOFF" CO.

**65 Shannon Street**

**Montreal**

THE CYCLOPEDIA *of*

# APPLIED ELECTRICITY

is a storage battery of electrical knowledge. It is charged right up to the minute with reliable information—it is the *real head of the Department* because it contains the work and knowledge of over thirty practical electrical engineers, experts and teachers. This work contains a complete record of their experiments, discoveries and observations. Just the information that the head of any electrical department should have at his finger tips for ready reference.

### You Can Add This Knowledge To Yours At Half Price If You Order Promptly

To introduce this great work, we will fill orders for the next thirty days at $18.60 per set, payable $2.00 after examination and $2.00 per month. The regular price is $36.00. Order promptly. The half price edition is limited.

**EXAMINATION FREE!** It won't cost you a dollar to examine the books. Just fill in the coupon. The books will be sent to you absolutely FREE of charge. You can return them at our expense if not satisfactory.

These six big volumes contain 2,896 pages, covering 4,000 different topics. Hundreds of special photographs, diagrams, sections, condensed tables and formulas. Page size 7 x 10 inches. Printed in large, clear type on special paper; substantially bound in half red morocco.

**IMPORTANT SUBJECTS TREATED**

Theory Calculation, Design and Construction of Generators and Motors; Electric Wiring; Electric Telegraph; Wireless Telegraphy; Telautograph; Types of Dynamos and Motors; Elevators; Direct Current Motors; Direct-Driven Machine Shop Tools; Electric Lighting; Electric Railways; Alternating Current Motors, etc.; Single Phase Electric Railway; Management of Dynamos and Motors; Power Stations; Central Station Engineering; Storage Batteries; Power Transmission; Alternating Current Machinery; Telephony; Automatic Telephone; Wireless Telephony, Telegraphone, etc.

With this special offer we will also include as a monthly supplement a year's subscription to the

TECHNICAL WORLD MAGAZINE

This is a regular $1.50 monthly covering present day scientific facts and inventions. An ideal magazine for the home because it is just enough different from the others to make it interesting. Fill in the coupon to-day—don't wait for to-morrow.

## American School of Correspondence

**CHICAGO, U.S.A.**

**FREE OFFER COUPON**

**American School of Correspondence:**

Please send Cyclopedia of Applied Electricity for FREE examination; also T.W. for one year. I will send $2.00 within five days and $2.00 a month until I have paid $18.60, otherwise I will notify you and hold the books subject to your order. Title not to pass until fully paid.

Name.....

Address.....

Occupation.....

Employer.....

POWER HOUSE—4—09

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock.....inside front cover
American School of Correspondence ..... 41
Andel & Co., Theo..... 39

**B**

Bain & Mitchell ..... 39, 48
Beaubien, De Gaspe..... 48
Brownell Co ..... 1

**C**

Canada Chemical Mfg. Co..... 5
Canada Metal Co ..... 39
Canadian Association of Stationary Engineers..... 47
Canadian Instrument and Testing Co..... 43
Canadian Steam Boiler Equipment Co..... 8

**D**

Darling Bros ..... 3
Dart Union Co..... 8
Death & Watson..... 48
Diamond Grate Bar Co ..... 7

**E**

Electrical Maintenance & Repair Co.....inside back cover

**F**

Farmer, John T..... 48
Featherstonhaugh..... 48
Francis, Walter J... ..... 48

**G**

Galt & Smith..... 48
Garde, John, & Co ..... 38
Gas & Electric Power Co..... 2
Goldie & McCulloch Co..... 10
Goodhue, J. L., & Co ..... 5
Goold, Shapley & Muir..... 3

**H**

Hawkins, W. T..... 39
Hercules Float Works ..... 38
Hill Electric Switch Co..... 48

**J**

Jenckes Machine Co..... 3
Jones & Moore Electric Co..... 38
Jones Underfeed Stoker Co..... 1

**K**

Kerr Engine Co ..... 47
Kilmer, Pullen & Burnham.....inside back cover

**Mc**

McLaren, D. K., Ltd..... 4
McLeod & Henry Co..... 45

**M**

Merrill, Edward B..... 48
Mitchell, C. H. & P. H. ..... 48
Morrison Brass Mfg. Co., Ltd., Jas.....outside back cover

**O**

Oliver, W. H. & Co ..... 2

**P**

Packard Electric Co., Ltd..... 42
Peiler & MacKenzie ..... 6
Penberthy Injector Co., Ltd .....outside front cover
Petrie, H. W..... 6

**R**

Rae, J. B ..... 48
Robb Engineering Co ..... 9
Robertson, Jas. L., & Sons ..... 39
Robertson, J. M ..... 48

**S**

Sadler & Haworth ..... 5
Saunnett, M. A..... 48
Shanly, J. M ..... 48
Sight Feed Oil Pump Co ..... 47
Skaleoff Co..... 41

**T**

Technical Books ..... 48

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 9


# Condensed Advertising

***RATES***

One insertion—25c. for 20 words; 1c. a word for each additional word.

Yearly rate—$2.50 for 20 words or less; 10c. a word for each additional word.

## DUPLICATING DEVICES.

IF INTERESTED in a Duplicating Machine for getting out circular letters, reports, price-lists, etc., or for printing various office forms, write for booklet and samples of work. The "POLYGRAPH" is the newest, latest and best, and sells for a lower price than the others. Is unexcelled by any similar device on the market. F. W. Tenney, Canadian Sales Agent, 123 Bay Street, Room 116 Stair Building, Toronto, Can.

## ELECTRIC LIGHTING.

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

## MISCELLANEOUS.

NOTICE—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator, and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts for the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ontario.

THE RELIABLE LIGHT will light your store 100% better than gas, electricity or acetylene. 600 candle power light costs 1 cent per hour to operate. Thousands in use. A safe, reliable, pure white light of intense brilliancy. Write for booklet M. The Rice-Knight Mfg. Co., Limited, 40 Lombard Street, Toronto.

Our complete equipment of labor saving devices and automatic machinery enables us to perform the different operations entering into the construction of incandescent lamps, with a perfection and uniformity not to be attained by even the most skilled hand labor and at a cost which permits us to spend more than the usual time in testing.

We make all standard candle powers and voltages.

The straight sided or moulded bulb is a "Packard" feature distinctive among Canadian products.

In ordering it is necessary to specify candle power, voltage and base.

Packard

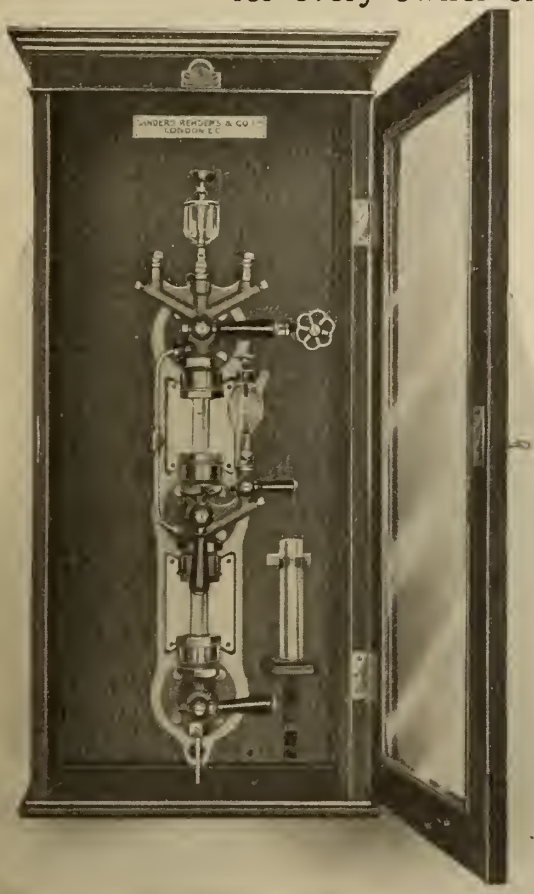
The Packard Electric Co., Limited

Head Office and Works: St. Catharines, Ont.

Branch Offices: Montreal, Winnipeg

# Instruments that positively SAVE MONEY

for every owner of a Steam Power Plant.



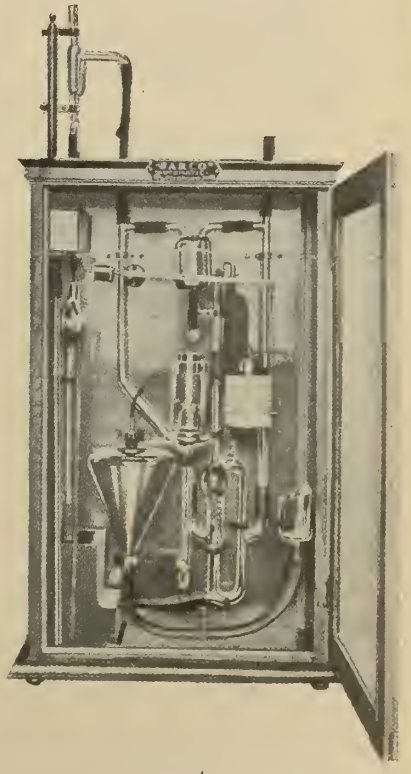
## Boiler Scale Prevention

is one of the toughest problems you have to face as the owner of a steam boiler. It is well known that Soda is the best preventative of Boiler Scale; the difficulty has been to know the right quantity to apply to the feed water. Thus more or less elaborate water softening plants often fail to prevent scale formation. But the problem has now been satisfactorily and inexpensively solved by the invention of the

# "SARCO"

## Feed Water Analyser

a small and simple instrument which analyses your feed water from day to day, infallibly indicating the exact amount of soda necessary to absolutely prevent the formation of scale in your boilers. We positively guarantee SARCO FEED WATER ANALYSER to give an absolutely correct analysis of any feed water to which it is applied.



## You Lose Money on Incomplete Fuel Combustion;

and if you had an instrument that would automatically tell you every hour just exactly how near perfectly your fuel was burning, you would save a lot of money; because "fore-warned is fore-armed." It would enable you to make provision to get a hundred cent's worth of combustion for every dollar's worth of fuel shovelled into your boiler furnace. There is such an instrument!—the

# "SARCO" Combustion Recorder

It automatically analyses the exit gases created by fuel combustion, and indicates upon a chart, in plain view all the time, the exact percentage of carbon dioxide which that gas contains. 20% Carbon Dioxide (C O 2) indicates practically complete combustion. Consequently the farther your furnace is from effecting complete combustion the more it is up to you to STOP THE WASTE.

Full particulars and prices sent immediately upon request.

# Canadian Instrument and Testing Co.

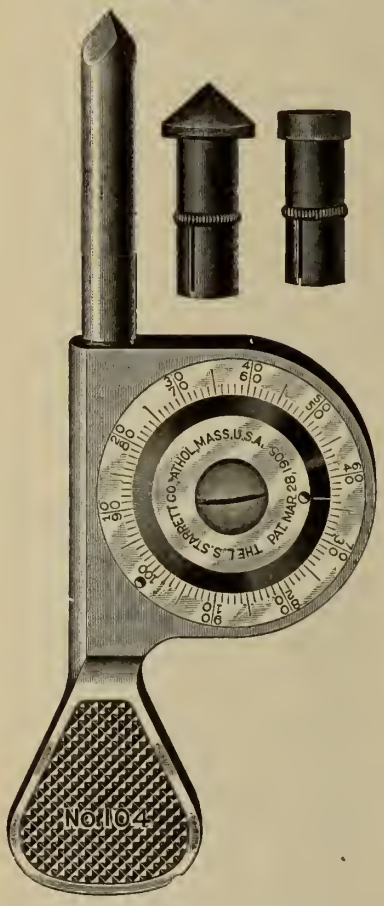
Montreal - - Canada

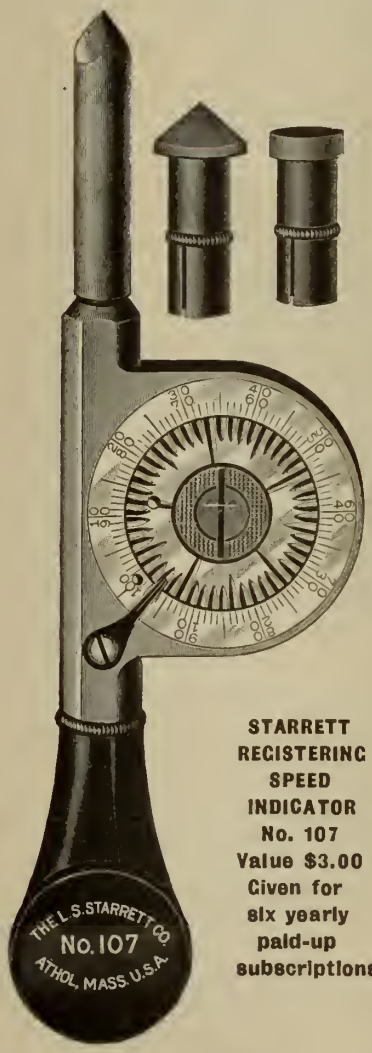
# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two, three or six others, and the indicator you are entitled to will be mailed to you immediately.

To subscribers who send us *two yearly paid-up subscriptions* we will send the $1.00 Indicator
To subscribers who send us *three yearly paid-up subscriptions* we will send the $1.50 Indicator
To subscribers who send us *six yearly paid-up subscriptions* we will send the $3.00 Indicator

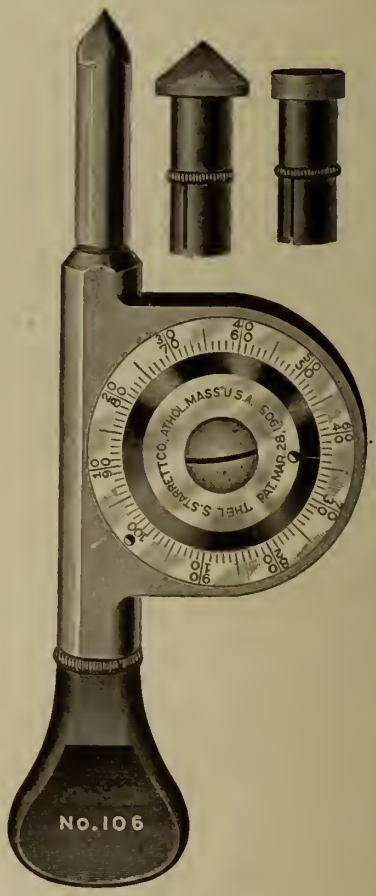
**STARRETT HIGH SPEED INDICATOR, No. 104 Value $1.00 Given for two yearly paid-up subscriptions.**




**STARRETT REGISTERING SPEED INDICATOR No. 107 Value $3.00 Given for six yearly paid-up subscriptions.**

**STARRETT IMPROVED SPEED INDICATOR, No. 106 Value $1.50 Given for three yearly paid-up subscriptions.**



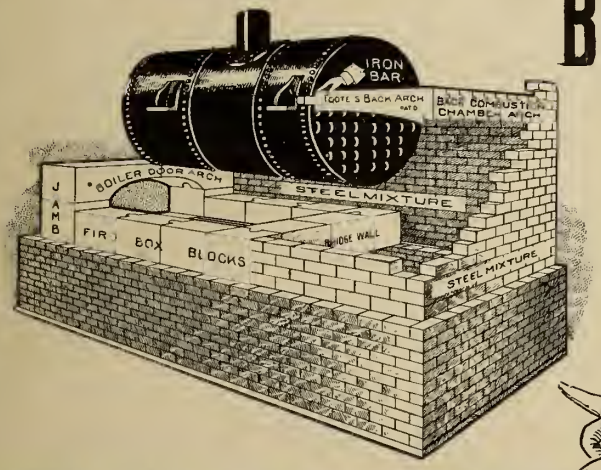

"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.

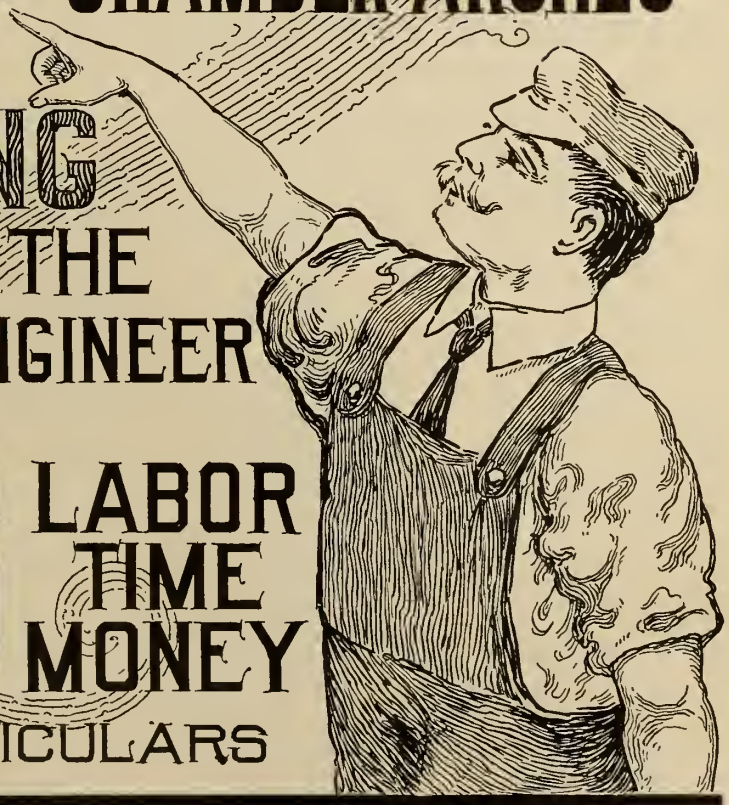
Start in TO-DAY to earn one of these Handy Tools.

**THE POWER HOUSE, 10 Front Street East, Toronto**

# "STEEL MIXTURE"




## BOILER DOOR ARCHES
## FIRE BOX BLOCKS
## COMBUSTION CHAMBER ARCHES



## THE SETTING
THAT SOLVES THE PROBLEMS OF THE ENGINEER AND

## SAVES LABOR TIME MONEY

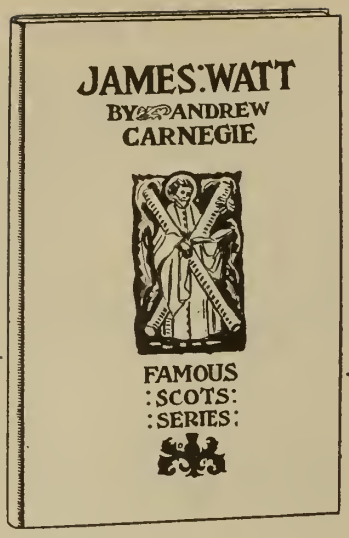
WRITE FOR PARTICULARS

MANUFACTURED BY

## McLEOD & HENRY CO.

TROY, N.Y., U.S.A.

BRANCH OFFICE, 1402 BROADWAY, NEW YORK CITY.




# Free to Subscribers

**A copy of this book for one new, paid-up subscription.**

This book records the life and achievements of James Watt, inventor of the Steam Engine.

It makes the best of reading for the modern engineer, telling of the difficulties encountered and overcome by the father of steam engineering.

Have you read it?

Here is your chance to get a copy **free** although you couldn't buy this book under a dollar.

Among your engineering acquaintances there is a man who ought to get The Power House every month—but doesn't.

You know The Power House—how instructive and valuable it is to the practical engineer.

Tell your acquaintance about it. Take his subscription for a year. You will be doing him a good turn without undergoing much effort.

Send us the dollar and his name and address and we will send you by return mail, **absolutely free,** a copy of "James Watt" by Andrew Carnegie, handsomely printed, bound in cloth boards, costing a full dollar to obtain any other way.

**DO IT NOW—THE BOOK IS YOURS.**

**THE POWER HOUSE** 10 Front Street East, TORONTO

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

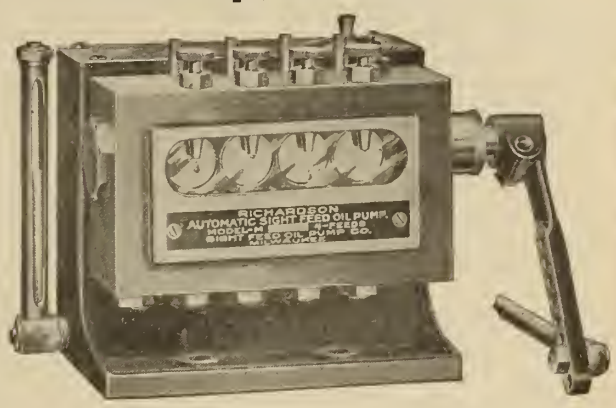
Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

## The Richardson Sight Feed Oil Pump, Model "M."

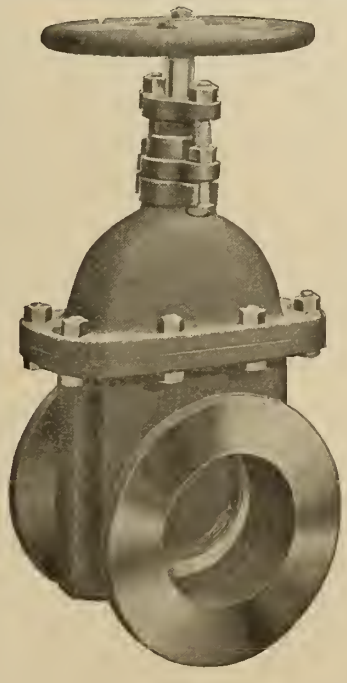



The Richardson Sight Feed Oil Pumps are made to economically lubricate engine or compressor cylinders—do it automatically—save your oil—prevent shut downs—and, of course, you know a well-lubricated cylinder means less wear—saving of steam—less expense for operation.

Bulletin No. 209-L. tells the story!

Manufactured by

**Sight Feed Oil Pump Co.**
**MILWAUKEE, WIS, U.S.A.**



## *KERR GATE VALVES*

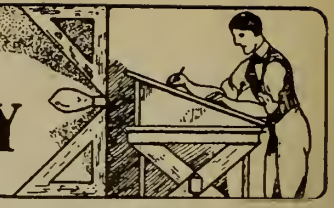
***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

***The Kerr Engine Co., Limited***
***Valve Manufacturers***
***Walkerville, - Ontario***

# PROFESSIONAL DIRECTORY



**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737 / East 5327 — 702 Canadian Express Bldg., MONTREAL

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Estimates, Reports, Plans and Specifications. Supervision of Power. Lighting and Railway Installat
Liverpool London and Globe Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS' BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**BAIN & MITCHELL**
CONSULTING and CONTRACTING ENGINEERS
SPECIALTIES—Marine, Stationary, Hydraulic, Engines, Boilers, Steam Power Plants, Reports, Tests. Inspections, Plans Specifications. Valuations and Genera Drawing Office Work.
SOLE CANADIAN AGENTS
Hawkins' Imperishable Jointing Cement.
Mansfield's Patent Oil Gas Apparatus.
The Ackroyd-Buckley Patent Steam Superheater.
The Kelghley Gas & Oil Engine Co.
Uptown 2526
Y.M.C.A. Bldg., MONTREAL

**CONSULTING AND SUPERVISING ENGINEERS**
You should have your card appear regularly on this page—you may miss important engagements by not being represented.

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

---

# Electric Switches

whether you want one or fifty, it will pay you to get our price.

Prompt shipment from a large, well assorted stock.

The best equipped factory in Canada devoted entirely to manufacture of switches and switchboards at your service.

**THE HILL ELECTRIC MFG. CO.**
1560 St. Lawrence Boulevard, - Montreal

# WATER POWER

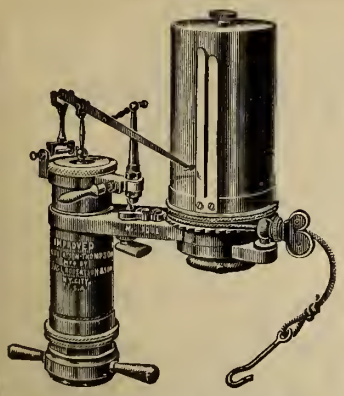
**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**
TECHNICAL BOOK DEPARTMENT
10 Front St East - - Toronto



A REMARKABLE OFFER

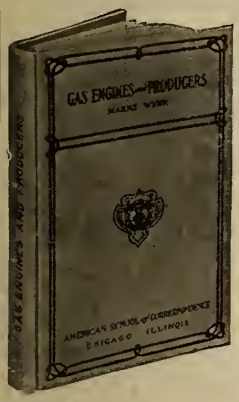
## Robertson Thompson Indicator and Victor Wheel

## $45

**$10** down, **$5** per month. No mortgage, simply good references.

**10%** off cash with order. Indicator **$35**, Wheel **$10**, Willis Planimeter **$12.50**, on the same basis. Let us send some testimonals, 10 years use.

**Jas. L. Robertson & Sons**
78-80 Murray St., New York




## The Gas Engine in Principle and Practice

*By A. H. Goldingham*

***Price $1.50, Postpaid***
***195 Pages, 107 Illustrations***

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Varporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

***Technical Book Department***

**The MacLean Publishing Co., Ltd.,** 10 Front St. East, Toronto

# Snaps for Quick Sale

## MOTORS AND GENERATORS

| | | | | | | |
|---|---|---|---|---|---|---|
| 1½ | H.P., | 110 | Volt, | (J. & M.) | Motor | (Used). |
| 2 | " | 110 | " | " | " | " |
| 3½ | " | 500 | " | " | " | " |
| 6 | " | 500 | " | " | " | " |
| 12 | " | 250 | " | (C.E.) | " | " |
| 7½ | " | 500 | " | (G.E.) | " | " |
| 15 | " | 500 | " | (U.E.Co.) | " | " |
| 25 | " | 500 | " | (J. & M.) | " | " |
| 150 | " | 500 | " | (U.E.Co.) | Generator | (New). |
| 400 | " | 3 phase | " | " | " | " |

Also our own make of brand new generators and motors (made under Johnson patents) in all sizes, both for A.C. and D.C. circuits, from ¼ to 500 H.P. or larger. The only MULTISPEED motor made in Canada. The only D.C. and A.C. Generators that can remain on SHORT CIRCUIT indefinitely.

## Canadian Electrical and Motor Co.

Limited
468-474 King Street West, TORONTO
Main 2425

# The Dymond Gas & Engine Co.

LIMITED

## 131 Queen St. East, TORONTO

MAKERS OF

# GAS PRODUCERS

PRESSURE AND SUCTION

FOR ANTHRACITE COAL

## Pressure Bituminous Plants for Large Instalations

# HIGHEST THERMAL EFFICIENCY

AGENTS FOR

CROSSLEY BROS. GAS ENGINES—Vertical and Horizontal, all sizes and types
WILLANS & ROBINSON STEAM TURBINES

If your present power is not satisfactory, advise us and we will help you out and guarantee results

# BABCOCK & WILCOX, Limited

"B. & W." PATENT

# Water Tube Boilers

WITH FURNACES FOR ALL CLASSES OF FUEL OR WASTE GASES

Highest Economy. Absolutely Safe up to the Highest Pressure

Over 7,000,000 H. P. in Use

also

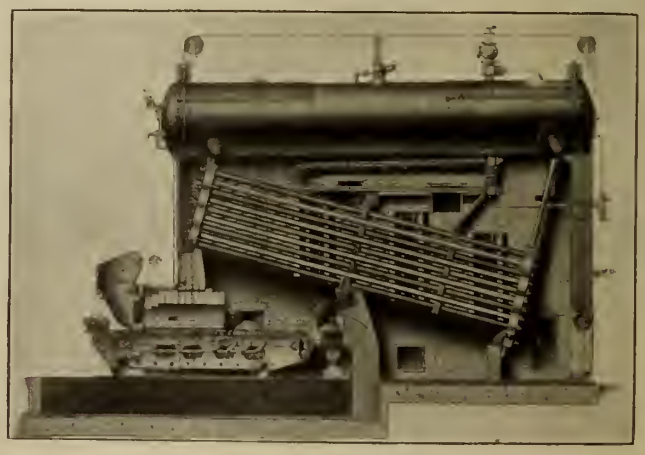
Steam Superheaters, Mechanical Stokers, Piping, Coal Handling Machinery, Steel Stacks, Feed Water Heaters, Water Softeners and Purifiers, Valves, Gauges, Accessories and Electric Cranes. : : :

COMPLETE POWER PLANTS DESIGNED AND INSTALLED

Sole Manufacturers in Canada of

## "NEEMES" Patent SHAKINGGRATES

Our Book, "Steam," sent on request



Babcock & Wilcox Patent Water Tube Boiler Superheater and Mechanical Stoker

Head Office for Canada:

New York Life Building, MONTREAL

TORONTO OFFICE, Traders Bank Building

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Belt Dressing.

Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Hygienic Laboratories, Toronto
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto

## Boiler Feed Pumps.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Wm. B. Pierce Co., Buffalo

## Boilers.

Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jeuckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnbam, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterwortb Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Peterboro Lubricator Mfg. Co., Peterboro

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Obio
Jas. Morrison Brass Mfg. Co., Toronto.
Penbertby Injector Co., Windsor.

## Lamps, Incandescent,

Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

### Lubricators, Force Feed.

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Sight Feed Oil Pump Co., Milwaukee, Wis

### Mechanical Stokers.

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

### Meters, Water and Electric.

Peiler & MacKenzie, Montreal

### Mill Machinery.

Allis-Chalmers Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg. Co., Lindsay, Ont
Waterous Engine Works Co., Brantford

### Mining Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

### Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Oilers, Gang.

Sight Feed Oil Pump Co., Milwaukee, Wis

### Oil Filters

Darling Bros., Montreal

### Oil Separators.

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Packing, Metallic.

Rhodes Improved Metal licPacking Co Montreal

### Panels, Electric

Hill Electric Switch Co., Montreal

### Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pipe Threading Tools.

Borden-Canadian Co., Toronto.

### Piping, Steam,

Babcock & Wilcox, Montreal

### Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Polish, Metal,

G. W. Hoffman, Indianapolis

### Power Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

### Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montrea

### Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pump Strainers.

Canadian Steam Boiler Equipment Co., Toronto

### Pumps, Air,

Lunkenheimer Co., Cincinnati, Ohio

### Pumps, Oil.

Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.

Goldie & McCulloch Co., Galt.

### Safety valves.

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

### Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,

### Shaking and Dumping Grate

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

### Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto

### Smoke Stacks.

Babcock & Wilcox, Montreal

### Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

### Steam Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

### Steam Separator.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto

### Steam Specialties.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

### Switches, Electric

Hill Electric Switch Co., Montreal

### Superheaters, Steam,

Babcock & Wilcox, Montreal

### Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co , Montreal

### Tanks, Blow-off

Darling Bros., Montreal

### Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford

### Tests and Inspections.

Bain & Mitchell, Montreal

### Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal

### Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Tubes, Boiler,

Babcock & Wilcox, Montreal

### Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd , Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

### Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

### Unions

Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio

### Vacuum Governors.

Canadian Steam Boiler Equipment Co., Toronto

### Vacuum Pumps.

Canadian Steam Boiler Equipment Co., Toronto

### Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Valve Reseating Machines

Darling Bros., Montreal

### Valves.

Canadian Steam Boiler Equipment Co., T ronto
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Standard Engineering Co., Toronto.

### Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

### Water Purifiers.

Babcock & Wilcox, Montreal

### Water Softeners.

Babcock & Wilcox, Montreal

### Watt Meters.

Gas & Electric Power Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock ..... inside front cover

**B**

Babcock & Wilcox ..... 58
Bain & Mitchell ..... 15, 61
Beaubien, De Gaspe ..... 67
Borden-Canadian Co ..... 9
Brownell Co ..... 10
Butterworth Foundry Co ..... 10

**C**

Canada Gas Power & Fuel Co ..... 10
Canada Metal Co ..... 14
Canadian Electric & Motor Co ..... 57
Canadian Instrument and Testing Co ..... 15
Canadian Steam Boiler Equipment Co ..... 4
Colonial Engineering Co ..... 71
Corbet Boiler & Machine Co ..... 56

**D**

Darling Bros ..... 13
Dart Union Co ..... 9
Death & Watson ..... 61
Diamond Grate Bar Co ..... 5
Dominion Electric Co ..... 72
Dymond Gas and Engine Co ..... 57

**E**

Electrical Maintenance & Repair Co inside back cover

**F**

Farmer, John T ..... 61
Featherstonhaugh ..... 61
Francis, Walter J ..... 61

**G**

Galt & Smith ..... 61
Garde, John, & Co ..... 61
Gas & Electric Power Co ..... 70
Goldie & McCulloch Co ..... 16
Goodhue, J. L., & Co ..... 68
Goold, Shapley & Muir ..... 8

**H**

Hawkins Co., W. T ..... 15
Hercules Float Works ..... 61
Hill Electric Switch Co ..... 72
Hoffman, G. W ..... 56
Hygienic Laboratories ..... 6

**I**

Ideal Steam Separator & Supply Co ..... 11

**J**

Jenckes Machine Co ..... 3
Johnson, F. M. G ..... 61
Jones & Moore Electric Co ..... 56
Jones Underfeed Stoker Co ..... 4

**K**

Kerr Engine Co ..... 64
Kilmer, Pullen & Burnham ..... inside back cover

**L**

Leonard, E., & Sons ..... 8
Levy & Westward ..... 63
Lunkenheimer Co ..... 65

**Mc**

McLaren, D. K., Ltd ..... 69
McLeod & Henry Co ..... 14
McRae, J B ..... 61

**M**

Merrill, Edward B ..... 61
Mitchell, C. H. & P. H ..... 61
Morrison Brass Mfg. Co., Ltd., Jas ... outside back cover

**O**

Oliver, W. H. & Co ..... 70

**P**

Packard Electric Co., Ltd ..... 72
Peiler & MacKenzie ..... 12
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 64
Pierce, W. B ..... 15
Plomo Specialty Mfg. Co ..... 15
Polson Iron Works ..... 2

**R**

Rhodes Improved Metallic Packing Co ..... 9
Robb Engineering Co ..... 8
Robertson, Jas. L., & Sons ..... 57
Robertson, J. M ..... 61
Russel & Gifford ..... 12

**S**

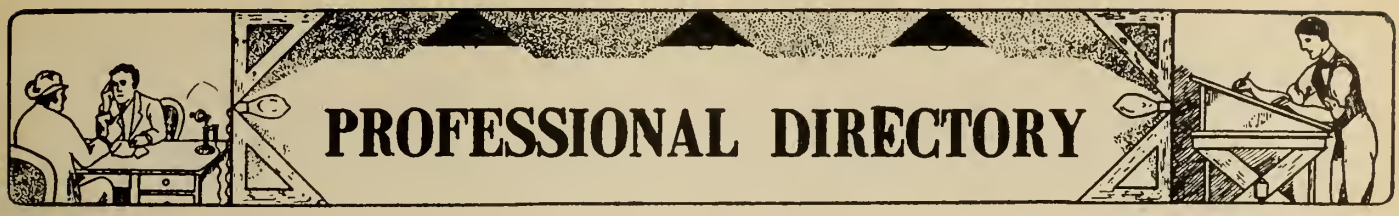
Sadler & Haworth ..... 68
Sammett, M A ..... 61
Shanly, J. M ..... 61
Sight Feed Oil Pump Co ..... 68
Skaleoff Co ..... 7
Smith, Kerry & Chace ..... 61
Snowdon, S. S ..... 6
Standard Engineering Co ..... 64

**T**

Technical Books ..... 66
Turbo-Blower Co ..... 10

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 15



# PROFESSIONAL DIRECTORY


**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, OUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST, WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

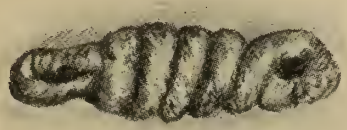
**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**SMITH, KERRY & CHACE**
ENGINEERS
Hydraulic, Steam, Electric, Railway, Municipal, Industrial
W.U. Code used. Cable Address "Smithco."
TORONTO — WINNIPEG — CALGARY
Cecil B. Smith — J. G. G. Kerry — W. G. Chace

**JOHN GARDE & CO.**
142 Victoria Street — TORONTO, ONT.
"Just around the corner from Queen and Yonge"
Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
**LEAD WOOL**
"SHREDDED LEAD."
MADE IN ENGLAND

**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 2716

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**HERCULES Seamless Copper FLOATS**
**Are Absolutely Reliable**

We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request.
**Hercules Float Works**
P.O. Box 396. — Springfield, Mass.

**EXPERTS**
ON
**SMOKE PREVENTION**
AND
**BOILER ROOM EQUIPMENT**
Canadian Representatives:
THE TRIUMPH STOKER, Leeds, Eng.
CONSULTING ENGINEERS
Steam — Hydraulic — Mechanical
**BAIN & MITCHELL,**
Y.M.C.A. BUILDING, MONTREAL.

# From Editor to Readers

**WITH the June issue our readers have before them a discussion of a very important topic - that of Boilers. In view of the great number of boiler explosions occurring east and west throughout Canada, we felt that an engineer could not know too much about Boilers and Boiler Room Equipment.**

The articles in this issue are written by men who have something worth while to say, and each subject is treated by a man who has had practical experience. There is something helpful on each page and we are never too old to learn. If you don't know it now, read it and learn. If you do know it now, read it anyway. You may possibly find something worth a whole lot to you.

The articles are brimful of good ideas and you will find them a pretty good diet, well worth digesting and good food for study and thought. A careful consideration of the articles in the June issue of The Power House will make you better acquainted with boilers in general, the various types, their strong points and their weak points.

The following are a few of the articles that appear in this issue; they form a fairly representative list of the contents, but all are full of meat, and you cannot afford to miss a single one.

**Consideration in the Design of a Return Tubular Boiler**

If an engineer is to understand what his boiler will stand, he must know something of its design. How otherwise could you understand how to deal with your boiler, repair it or give it the necessary care that a boiler calls for? Turning a valve and shutting it again, isn't all an engineer has to do. He must be an Engineer. He must understand his business and that includes a knowledge of his Boiler. This article is very complete and should prove of wide interest.

**Calculation of Horse-power of Steam Boilers.**

Several methods are followed in calculating the horse-power of a boiler. These are taken up in this article. There are certain short-cuts and they are all given. This article will show you how to arrive at the proper capacity of a boiler for a certain horse-power engine.

**Practical Letters and Correspondence.**

The readers of The Power House, anticipating a Boiler Number, sent in some good boiler articles. A number appear in this issue, including discussions on previous questions. These are written by engineers with practical experience; by men who know what they are talking about, or they wouldn't hold the positions they do. Read 'em. If they give you an idea, write us about it. You may have something better. Let your brother engineers know about it.

"A little nonsense now and then, is relished by the wisest men." Pretty good story for you this month. It's worth reading. 'Nuther one for you next month. A good laugh is better than a pill after dinner. Enjoy this story by reading it.

**Course of Lessons for the Instruction of Stationary Engineers.**

We have kept the announcement of Mr. Crockett's lessons to the last. The one in this issue is written especially for the Boiler Number. Those who have been following Mr. Crockett's lessons know that the executive secretary knows what he is talking about.

Not all the good things that have been planned for this issue find a place in it,. but they make an impressive showing and give you an idea of what is coming. We have tried to make the June Boiler Number a useful one. If we have pleased you or given you something helpful let us hear from you. A word of encouragement now and then will make the editors smile at their work. Make us laugh. It will be reflected in the pages of The Power House.

**¶ REMEMBER——the June issue is only a foretaste of the good things we have in store for you. If you haven't subscribed yet, NOW is the time, and you won't be disappointed. This is your opportunity. If you are a subscriber, tell your brother engineer about this issue, and don't forget to let us know what you think of it.**

THE POWER HOUSE

10 FRONT STREET EAST, TORONTO

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisementa of "Machinery Wanted" or "For sale" will be inserted in this Department at the rate of 12 cents per line each inaertion, on the basia of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be uaed in 12 months. Write or rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable n advance.

Advertisementa must be received not later than the 7th of each month to inaure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five years.

Second-hand Engine Lathe, 56" x 16 ft. bed; swing over carriage 44"; independent compound rest, in good condition.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1¼" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### Machinery Wanted

Boiler wanted, 40 h.p. borizontal tube. Must be in first class condition. State full particulars. Imperial Extract Co., Toronto. (6)

D. Maxwell & Sons, St. Mary's, Ont., want Second-hand Air Compressor in good condition. Belt driven, with capacity of about 100 cubic feet free air per minute.

### For Sale

Machinery for Sale—1 2nd hand 15½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in firat-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

One Second-hand Slide Valve Engine, 14 x 18.
One Second-hand Slide Valve Engine, 10 x 15.
One Second-hand Slide Valve Engine, 12 x 16.
New Return Tubular Boilers, 60 x 14 and 72 x 18.
Second-hand Return Tubular Boilers, 36 x 10, 44 x 12, 48 x 12.
OWEN SOUND IRON WORKS, Limited, Owen Sound.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.
2 single cold water pumps.
The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

Transmission Machinery—Write us for prices on shafting, hangers, pulleys, etc.; will promptly figure on any specifications submitted.

Flour Mill Machinery.

The Brown Automatic Engine.

Boilers.

The STRATFORD MILL BUILDING CO., Ltd., Stratford, Ont.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta.

### For Sale

A 3 h.p. 2 phase 110 volt 66 cycle Canadian General Electric Motor, in good shape—a bargain. Also a 5 h.p. and a 15 h.p. Motor, and transformers in stock.

NORTHERN ELECTRIC SUPPLY CO.,
(5) Orillia, Ont.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

### For Sale

## Levy & Westwood Machinery Co.

Have the following for sale:—

**REFITTED HORIZONTAL RETURN TUBULAR BOILERS**

1—72" x 13'6"
1—44" x 13'6"
2—54" x 12'
1—54" x 14'
1—44" x 11'6"
1—54" x 8' Clyde Style. on skids.
1—54" x 8' Clyde Style.

**REFITTED UPRIGHT BOILERS**

1—48" x 94"—104-2" tubes.
1—46" x 72"—100-2" tubes.
1—42" x 80"— 86-2" tubes.

**REFITTED PORTABLE ENGINES AND BOILERS**

1—10 H.P. Cornell on wheels.
1—12 H.P. Waterous on wheels.
1—12 H.P. Whitelaw on skids.

**REFITTED SAW MILL ENGINES**

1—15" x 18" stroke.
1—13" x 18" stroke.
1—10" x 16" stroke.
1—10" x 14" stroke.
1—9½" x 12" stroke.
1—9" x 16" stroke.
1—8" x 12" stroke.
1—6" x 10" stroke.
1—40 to 50 H.P. Hardill Compound.
1—25 H.P. Hardill Compound.
1—18 H.P. Automatic Horizontal Engine.
1—35 H.P. Automatic Vertical Engine.
1—Twin Vertical Marine Engine 3½"x4" cylinder.
1—MacGregor Gourlay Bolt Cutter up to 1½".
1—Jno. Bertram Bolt Cutter up to 1½".
3—Pipe Threading Machines up to 3".
1—40" Lefell Water Wheel.
1—18" Little Giant Water Wheel.
1—16" Little Giant Water Wheel.
1—Pair of Mortise Bevel Gears 48" and 24"—6" face.
1—24" x 6" Double Suriacer and Matcher., Mnfrd. Major Harper.
1—24"x4" Goldie & McCulloch Planer & Matcher.
1—24" x 6" Cant Planer and Matcher.
1—30" x 6" Smoothing Planer.
1—26" x 10" Double Suriacer Planer.
1—24" x 8" Revolving Bed Surface Planer.
1—MacGregor Gourlay Double Cut Off Saw (Roller table.)
2—Double Gear Hand Hoisting Winches.
50' of new 1¼" Marlin Wound Steam Hose.

**SUPPLIES OF ALL KINDS**

PHONE M. 1375

Address:—

## Levy & Westwood Machinery Co.

102 FRONT ST. WEST - TORONTO

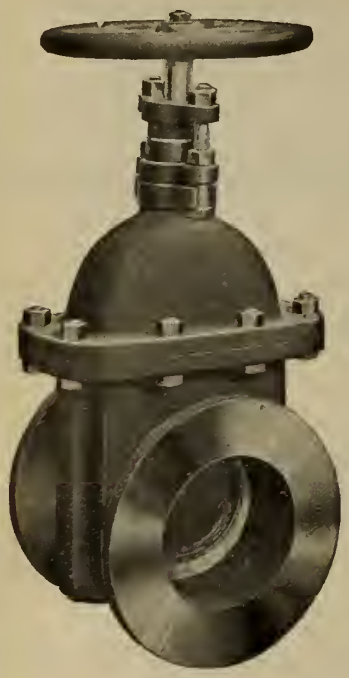
### SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

THE POWER HOUSE
10 Front St. East, TORONTO



## KERR GATE VALVES

*are to be found in all well equipped steam plants in Canada.*

*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

**The Kerr Engine Co., Limited**

**Valve Manufacturers**

**Walkerville, - Ontario**

# FREE

**ON 30 DAYS' TRIAL**

## "Standard-Crown" Globe and Check Valves

For Steam, Air, Water or Gas.
For any Pressure or Temperature.
Have Removable Seats of very hard Phosphor Bronze.
Repairs cost absolutely nothing
Have no Soft Discs.
Can be Packed under Pressure.
Have Full Discharge.
No Regrinding Machines Required.
Are fitted with Gland Followers

**Canada's Highest Grade Valves**

**Are unequalled for quality of material and excellence of workmanship.**

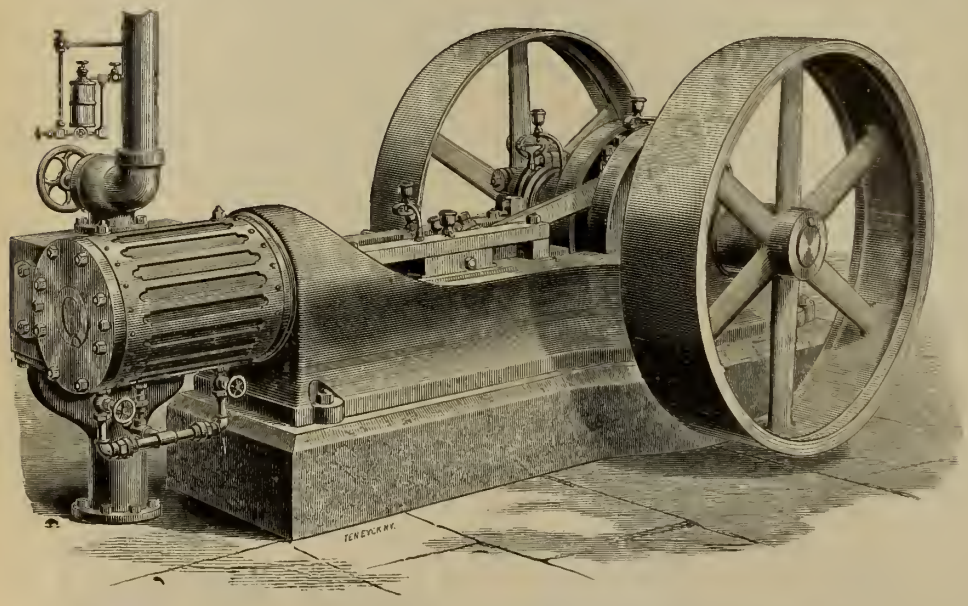
We will send one or more valves to any company or engineer writing on their company's letter head, free of charge on 30 days' trial. If not satisfactory we will take it back. It won't cost you a cent to try, anyhow.

*Send Us a Trial Order or Write for Catalogue*

**The Standard Engineering Co.**

43 Scott Street, Toronto.

# Power Equipment

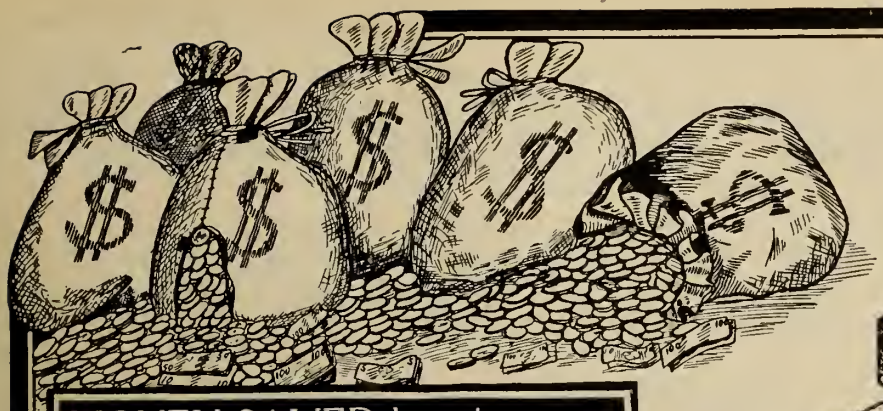


Automatic Engines
Horizontal Engines
Marine Engines
Vertical Engines
Fire Box Boilers
Horizontal Boilers
Marine Boilers
Vertical Boilers
Hoisting Engines
Gasoline Engines
Electric Motors
Water Wheels

**Our supply catalogue or machinery stock list for the asking**

# H. W. PETRIE, Limited

TORONTO MONTREAL VANCOUVER



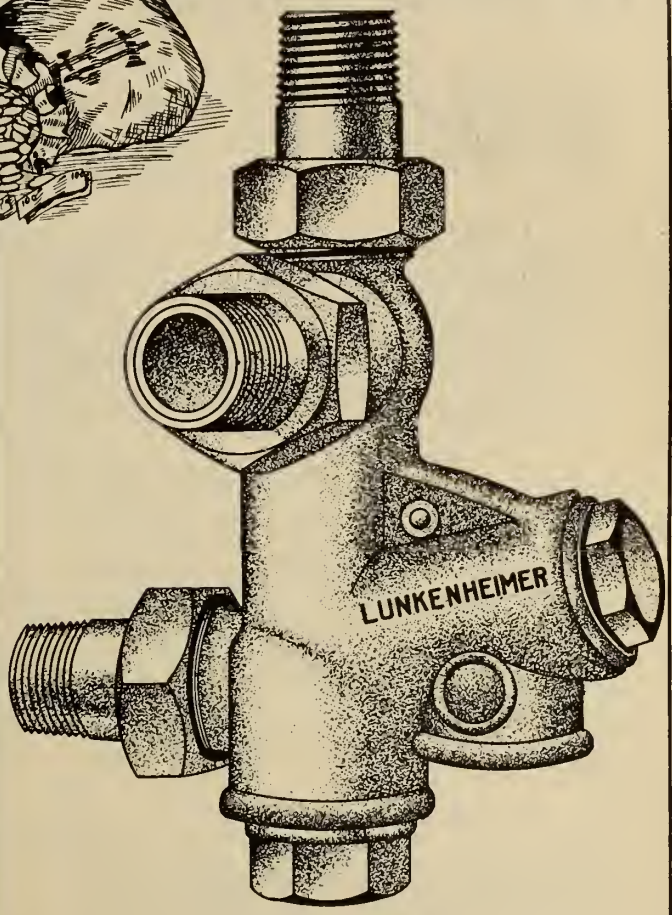
MONEY SAVED by using
Lunkenheimer
Automatic Injectors or Ejectors

because they will deliver more water per pound of steam; will lift the water higher, force against a greater over-pressure and will take hotter water than any other make.

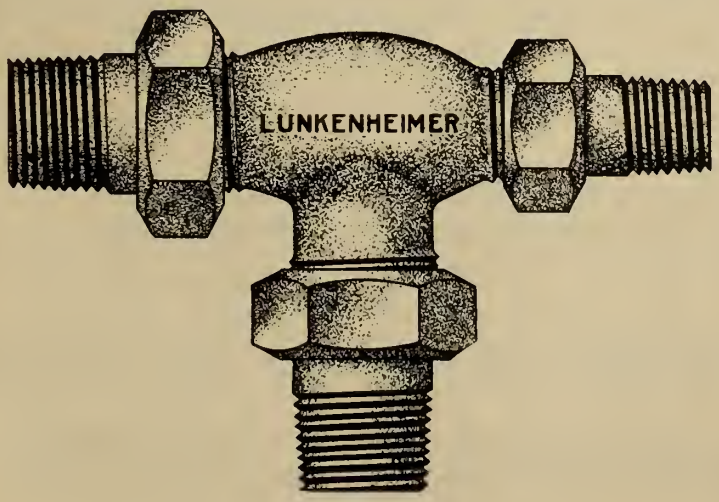
The tubes are made of a special hard bronze composition and will stand long and severe usage.

Very efficient and exceptionally durable. Made in all standard sizes.

Our catalog will tell you more about them. Write for a copy. It's free.




"MOST SUPPLY HOUSES SELL THEM YOURS CAN IF THEY DONT OR WONT—TELL US."




The
Lunkenheimer
Company

Largest Manufacturers of High Grade Engineering Specialties in the World

General Offices and Works:
Cincinnati, Ohio, U.S.A.

Branches:
New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E. 35 Great Dover St.

# Which Book Do You Prefer?

Below is a list of books, every one of which is extremely interesting and helpful to Engineers, and you may secure any one of them, or all of them

**ABSOLUTELY FREE OF COST.**

Here is our proposition to you :

As a subscriber to The Power House, you know it is a publication that you can honestly recommend to Engineers. Well, by recommending The Power House to your engineering acquaintances and taking their paid-up subscriptions you can have any of the following books on this basis :—

## For one new paid-up subscription a choice of these two books :

**STEAM BOILERS.** By William S. Newell, S. B., with Bath Iron Works, formerly Instructor Massachusetts Institute of Technology, and Carl S. Dow, S. B., American Society Mechanical Engineers. 160 pp., 140 illus. Cloth binding. A practical treatise on the materials and approved methods of construction of steam boilers, with complete instruction in the mechanical details of the various commercial types of stationary boilers, such as the vertical, horizontal, water-tube, fire-tube, etc. Value.....**$1.00.**

**BOILER ACCESSORIES.** By Walter S. Leland, S. B. Assistant Professor of Naval Architecture, Mass. Institute of Technology, American Society Naval Architects and Marine Engineers. 144 pp. 80 illus. Cloth binding. A treatise giving complete descriptions of the various accessories of the boiler room and engine room essential to economical operation, such as evaporators, pumps, feed-water heaters, injectors, mechanical stokers, etc., with practical instruction in their use. Value....**$1.00.**

## For two new paid-up subscriptions a choice of these two books

**A POCKET BOOK FOR BOILERMAKERS AND STEAM USERS.** By Maurice John Sexton, comprising a variety of useful information for employees, Government inspectors, Board of Trade surveyors, engineers in charge of works and ships, foremen and every user of steam power. Leather Binding. Value.....**$2.00.**

**STEAM BOILERS.** Their Management and Working on Land and Sea. By James Peattie. 230 pages, 35 illustrations, cloth binding. Covers the whole art of keeping steam boilers in fine working order under all sorts of conditions. This is a splendid book. Value.....**$2.00.**

## For three new paid-up subscriptions a choice of these two books

**KLEINHANS.** Boiler Construction. The only book showing how locomotive boilers are built in modern shops. Shows all types of boilers used; gives details of construction ; practical facts, such as life of riveting punches and dies, work done per day, allowance for bending and flanging sheets and other data that means dollars to any railroad man. 421 pages. 334 illustrations. Six folding plates. Value.....**$3.00.**

**BUCHETTI.** Engine Tests and Boiler Efficiencies. This work fully describes and illustrates the method of testing the power of steam engines, turbine and explosive motors, the properties of steam and the evaporative power of fuels. Combustion of fuel and chimney draft; with formulas explained or practically computed. 255 pages. 179 illustrations. Value.....**$3.00.**

Don't miss this opportunity to secure valuable technical books free of cost. The subscription price to The Power House for one year is one dollar, and **you know** that it is splendid value for the money.

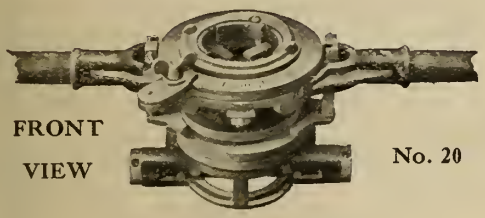
## THE POWER HOUSE, 10 Front St. East, Toronto

**N.B.—If you do not get these subscriptions, any of these books may be secured from us at the price mentioned after each book.**

# Every Man Who Threads Pipe

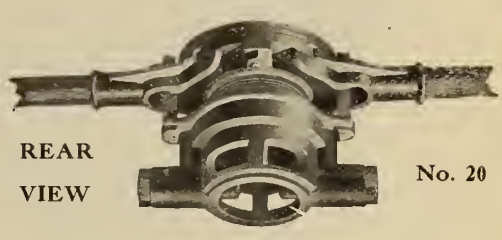
ought to know the facts about our

# New No. 20 "Beaver" Die Stock



FRONT VIEW No. 20

Showing Detachable Leader Screw and Ring



REAR VIEW No. 20

Number 20 "Beaver" cuts 1-in., 1¼-in., 1½-in., 2-in. pipe. One boy can successfully operate this tool.

It is our old No. 2 greatly improved, threading from 1 to 2-inch pipe without changing dies. It has a new centering device for fastening the stock to the pipe so that no bushings are necessary for the different sizes of pipe. The rear opening is large enough to take in a 2-inch coupling for threading short nipples. The parts subject to wear are detachable and may be replaced at slight cost.

NUMBER 4 "BEAVER"

Cuts 2½-in., 3-in., 3½-in., 4-in. pipe. With a ratchet handle one boy can thread 4-in pipe.

FRONT VIEW No. 6 "BEAVER"

Cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by a single cam, so constructed as to move one set of dies back while the other set is in use.

# 30 Days Free Trial Offer

To prove our claim that "Beaver" Die Stocks are the cheapest, most accurate and fastest Pipe-Threading Tools on the market, we will send one to any engineer on 30 days' free trial. **Send for one.** If it does not give you better, quicker service than any Die Stock you ever saw before—send it back at our expense. This is a genuine offer--it costs you nothing to investigate.

Send for any one of these

# Borden-Canadian Company

66 RICHMOND STREET EAST - - - - - TORONTO, ONT.

"AMPHIBIA" (WATERPROOF) "CLIMAX"

WRITE FOR PRICES

SADLER & HAWORTH

FACTORIES AT

MONTREAL—TORONTO

Branches:—

St. John, N.B., Winnipeg, Calgary, Vancouver

Union-Cinch Fittings

They are more economical than other fittings. There are points of superiority that are as exclusive as they are unique. These features mean a saving in *actual dollars* to every mao who uses fittings.

They elimioate all need of soldering, flaring out the eods of tubing or pipe, and threading the ends of pipe. They alsɔ make the use of cement and solder unnecessary.

Every UNION-CINCH Fitting is a UNION, as the pipe may be taken down at any point where a fitting is inserted. UNION-CINCH joints are made *absolutely* tight in a few seconds, and may be taken dowo and made tight again.

*Send for Bulletin No. 110-L, which clearly explains where the saving occurs.*

Sight Feed Oil Pump Co.

Milwaukee

# "Experience Keeps A Dear School But Fools Will Learn in No Other."

*—Franklin.*

Does this apply to YOU? Are you learning by costly experience that it is a bad policy to use a poor, cheap belt lacing?

Be on the safe side and order a Lace Leather that is as near perfect as can be made.

Strong as Rawhide but with the advantage of being tanned, and is soft with no stretch. It is a buffed lacing.

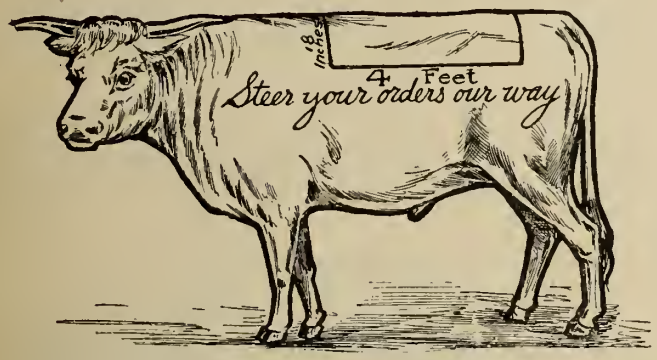
**Get in right, specify this brand:**

**Send for a Sample Piece.**

THE GOODHUE LACE LEATHER
MANUFACTURED BY
J.L.GOODHUE & CO.
DANVILLE, QUE.

**In writing for Sample use your firm's letter head.**

# This is the Spot




the toughest and most perfect part of a steer's hide — from which the best belting leather is obtained. Other parts of the hide are cheaper; and, when lapped up into belting lengths, don't LOOK too bad. But LOOKS don't amount to much. Long experience has demonstrated that only the BACK makes good belting. That is why

## D.K. McLaren's GENUINE BRITISH OAK TANNED LEATHER BELTING

can be relied upon for the maximum of strength and durability. Only flawless back leather is used. And our Genuine British Oak Tanning Process preserves every bit of the hide's natural strength.

Our best testimonials come in the form of continuous repeat orders from many of Canada's largest industries.

OUR REGULAR LINES ARE

**EXTRA "C" AND STANDARD "B"**

SPECIAL BELTS MADE TO ORDER
WRITE FOR PRICE LIST

## D. K. McLAREN, LIMITED

| MONTREAL | TORONTO | QUEBEC | ST. JOHN, N.B. | VANCOUVER |
|---|---|---|---|---|
| 309.311 Craig Street West | 200 King Street West | 21 St. Peter Street | 64 Prince William Street | 418 Abbott Street |

Full Stock of Our "Extra C" Leather Belting and "D.K." Balata at Above Addresses

**The World of Industry has been waiting for this!**

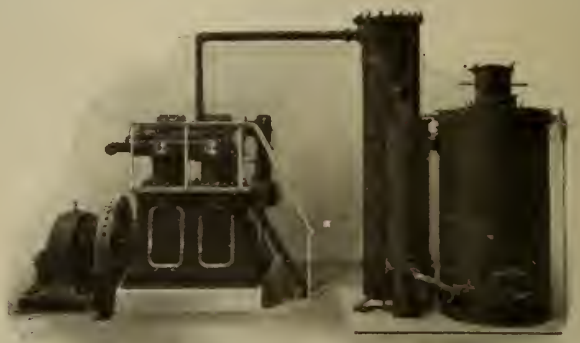
Cheap Power! is the cry that rises from manufacturers the world over. But, in addition to cheapness the element of reliability is essential. In response we say, Instal a

# Warren Gas Power Plant

It has solved the cheap power problem. It is fully as reliable as the best form of steam power, but not nearly so expensive to operate. And we don't ask you to take our word! Before you are asked to sign a cheque the cheapness and reliability of Warren Engines are demonstrated right before your eyes. Don't hesitate to investigate--make a start towards cheaper power by writing for our illustrated literature.

*It is intensely interesting to progressive manufacturers*

*WRITE FOR IT TO-DAY*



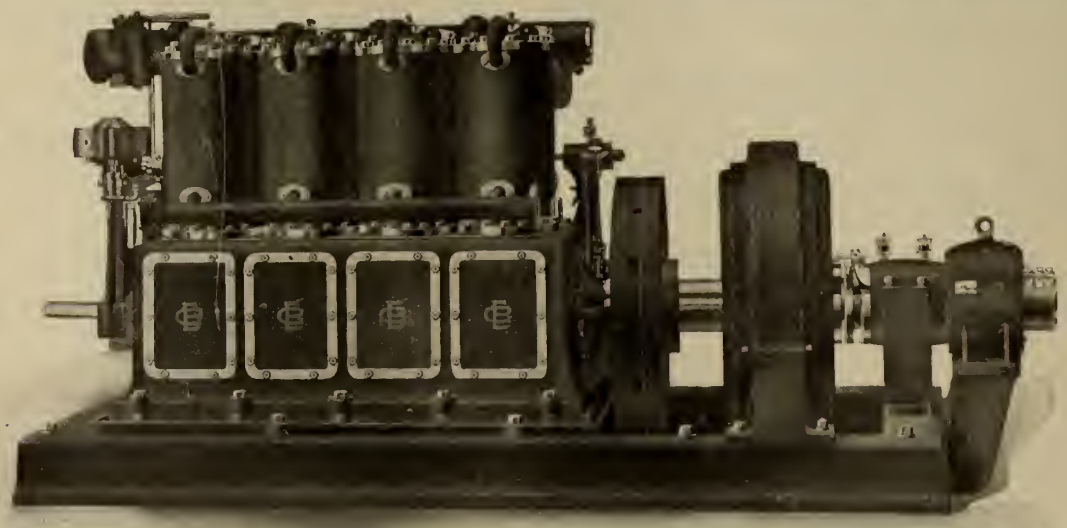
Cut shows the Warren Vertical Automatic Gas Engine and Suction Gas Producer, manufactured by the Struthers-Wells Co., Warren, Pennsylvania, in sizes to 300 h.p. Other equally efficient types, from 10 to 1,000 h.p.

## W. H. Oliver & Co.

Exclusive Sales Agents for the Struthers-Wells Co., Warren, Pa.

M 509 McKinnon Building, **Toronto**

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants Pressure Gas Plants



Engine direct connected to alternators, guaranteed to run in parallel successfully.

Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.

Stair Building, Bay Street - TORONTO

# WITH ALL DUE RESPECT

to the fact that this is a special "Steam Boiler" number of POWER HOUSE, we can't resist the temptation to make a remark or two about GAS.

¶ We admit that it is unkind of us to embarrass our steam friends by insisting upon playing ball at their picnic—getting right into their own meeting and telling their own audience that

# THE DIFFERENCE

between the best showing that a steam plant can make and the best showing that a Hornsby-Stockport gas engine plant can make is about **200%**.

¶ A steam plant, consisting of good steam boilers, steam engines and all the complicated and high-pressure auxiliary apparatus, will convert into work done—that is to say, actual brake horse power on the engine shaft—only about **ten cents** out of every **dollar's** worth of coal burned.

¶ A Hornsby-Stockport gas engine plant will convert into work done THIRTY cents out of every dollar's worth of coal burned.

¶ The steam engine and boiler builder (and those who are not already in it are trying hard to get into the gas engine business) will tell you that inasmuch as you have to heat your premises in Canada for seven months in the year, the thing to do is to put in a steam plant and do your heating with exhaust steam. In other words, "Make the best of a bad job."

¶ When he gets into gas engine building he THEN tells you—just as we do now—to do it right in the first place by putting in gas engines, and in addition to their wonderful economy in fuel, use (as we have already demonstrated) the heat from the exhaust gas for heating—making up the slight difference with additional coal—still saving from **25** to **50%** in your total coal bill for **LIGHT, HEAT** and **POWER.**

¶ And it might be well to remember that with Hornsby-Stockport gas engines there cannot be an explosion, for the simple reason that there is not any pressure to cause one, and fatal steam-boiler explosions—such as occurred recently in Toronto and Montreal—need not be reckoned with or insured against.

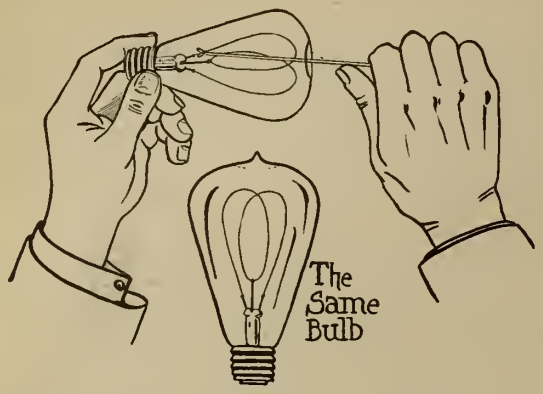
¶ When we came to Canada two years ago we said we could produce the cheapest and most reliable power on earth, and we can now show **twelve installations** in which we are proving what we said we could do—and the owners of every one of those plants will confirm our claims.

¶ And we will do the same thing for you if you give us the chance.

# COLONIAL ENGINEERING COMPANY LIMITED

**SOLE CANADIAN AGENTS**

**222-224 ST. JAMES STREET, - - MONTREAL**




# THE WAY IT IS DONE

Refilled from the bulb end and the quality of the lamp in no wise impaired, but rather in some cases enhanced. All lamps guaranteed perfectly clear, high grade and efficient. Lamp users and jobbers can make money on this up-to-date proposition.

WE REFILL LAMPS WE SELL REFILLED LAMPS

Write for our prices. Save your burn-outs.

## THE DOMINION ELECTRIC CO.

EXPERT LAMP REFILLERS

ST. CATHARINES, - - - ONTARIO

# THE WATER TEST

## Packard

## Type "D" Motor

Reproduction from an actual photograph, showing the "Water Test" as applied to a Packard Type "D" Motor.

shown in the picture, proves one of the many points about the PACKARD Type "D" Motors, that combines to make them peculiarly adaptable for severe operating conditions.

The test consisted of a submersion of the motor in a tank. Connection being made to the circuit, the motor was allowed to run—completely under water—for several hours at a time—and, after repeated tests, the insulation was found to be in no-wise affected.

Could you ask better proof of the **ruggedness of design** and **careful construction** of the motor; or of the success of our Vacuum process of insulation?

## The Packard Electric Co., Limited

Head Office and Works
St. Catharines, Ont.

Branch Offices
Montreal and Winnipeg

# SWITCH-BOARDS

**Avail yourself of our**

**Experience and Facilities**

**in switch-board construction**

## The Hill Electric Switch and Mfg. Co.

1561 St. Lawrence Street, - Montreal

# WATER POWER

**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

## MACLEAN PUBLISHING COMPANY

**TECHNICAL BOOK DEPARTMENT**

**10 Front St East - - Toronto**

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419



# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

# Engineers' Supplies

# Inspirators

The **HANCOCK INSPIRATOR** is a double Tube Boiler Feeder having two sets of Jets (one set for lifting, the other set for forcing). In this respect it differs from the Injector type of single tube construction.

No adjustment necessary for varying steam pressures.

Simple in operating.

Works at comparatively high or low temperature.

Has stood the test of over 20 years of successful service.

The GENUINE HANCOCK

# and

The IMPROVED "J.M.T." INJECTOR

Simple, Efficient, Durable

# Injectors

**J.M.T. INJECTORS** are made of highest grade steam metal to insure **UTILITY** and **DURABILITY**. They combine latest and best features in injector construction. The **IMPROVED J.M.T. INJECTOR** operates from 20 to 220 lbs. steam pressure,—a wider range than any other known machine.

It has improved drain valve, to drain off condensation and thus prevent liability to freeze in cold weather. This valve also proves a convenient source of supply for hot water.

(All machines thoroughly tested and fully guaranteed.

## The James Morrison Brass Mfg. Co., Limited

93-97 Adelaide Street West, TORONTO

CIRCULATES IN EVERY PROVINCE OF CANADA.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL, 232 McGill St. TORONTO, 10 Front St. East WINNIPEG, 511 Union Bank Bldg. LONDON, ENG., 88 Fleet St. E.C

Vol. II. Publication Office, Toronto—May, 1909 No. 5

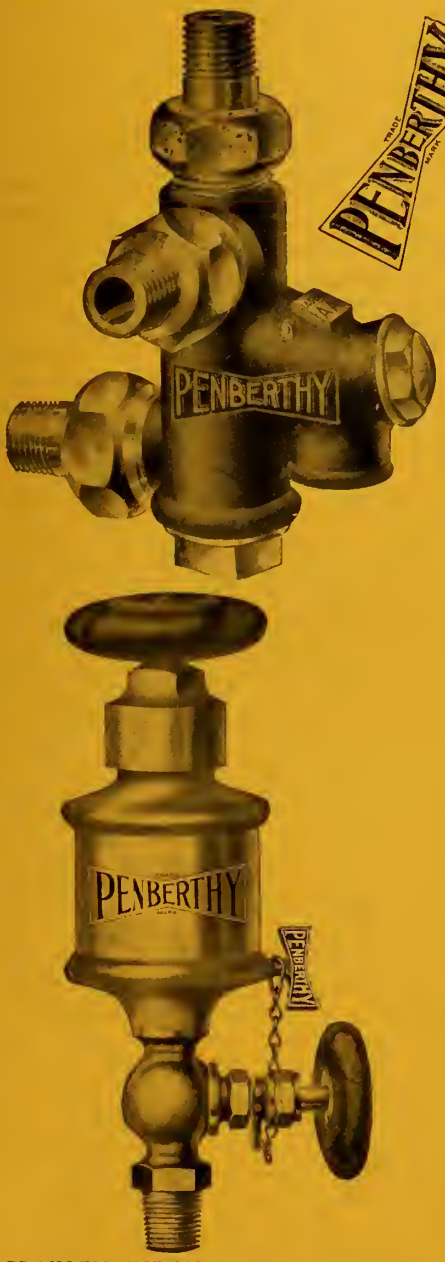
GENUINE
PENBERTHY
Automatic Injectors
HAVE STOOD THE TEST

They are acknowledged by all leading power users, and all intelligent engineers to be superior in every respect to all others.

BECAUSE

They will start on lower and work on higher steam pressure.
They have a stronger vacuum capacity.
They will handle hotter water. They are self-draining.
The jets are made from a special mixture of metal, and are mechanically perfect in workmanship.

"THEY ALWAYS WORK"




PLAIN ENGINE LUBRICATOR. The filler end of the oil body is made with a square thread and when the filler plug, the seat of which is filled with a soft metal, is screwed down in place it makes a very tight connection, insuring both strength and safety on high pressures.

STANDARD STEAM WHISTLE. Made of the best metal and carefully finished. They produce a very fine tone.

"SAMSON" SCREW COMPRESSION GREASE CUP. Good metal, well finished, will stand a lot of hard usage. An absolute, positive feed. A very reliable grease cup.

MANUFACTURED BY

PENBERTHY INJECTOR CO., Limited, WINDSOR, ONT.

# POWER PLANT EQUIPMENT

***ENGINES*** ***PUMPS***

***BOILERS*** ***CONDENSERS***

***FEED-WATER HEATERS***

***WATER-TUBE BOILERS***

IN STANDARD UNITS OF 100 H.P. AND UPWARDS—SEND FOR BULLETIN 105

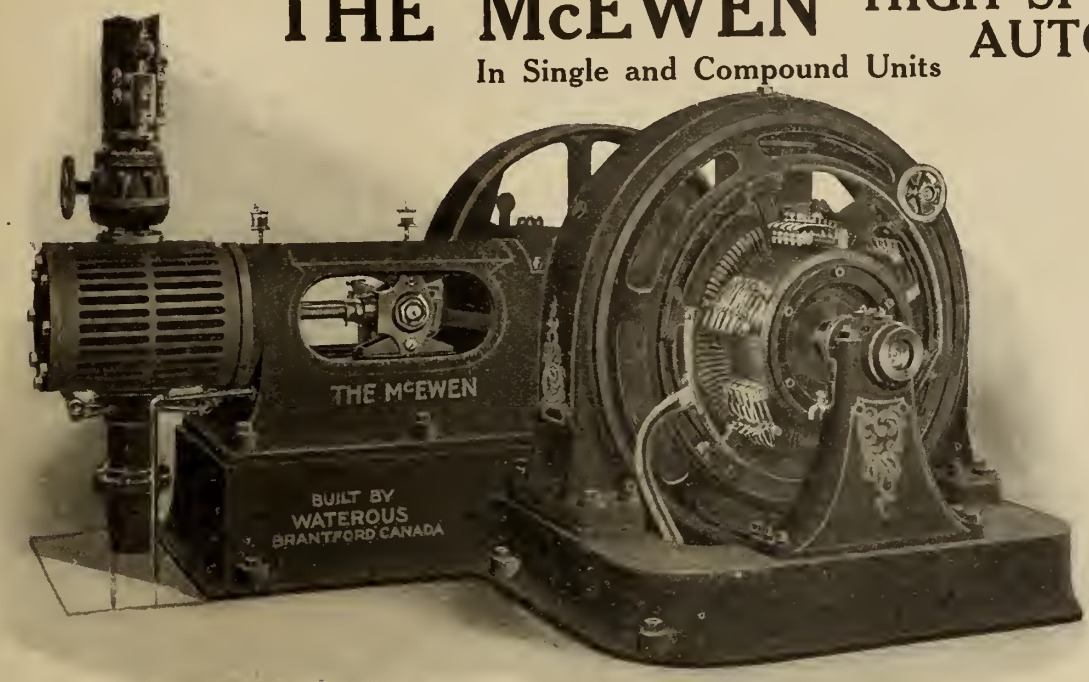
## *THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO.*

*LIMITED*

***Sales Offices :*** ***MONTREAL, TORONTO, WINNIPEG, VANCOUVER, COBALT, CALGARY.***

# THE McEWEN HIGH SPEED AUTOMATIC

In Single and Compound Units




Specially Suited for Direct Connected Electrical Works.

Cut illustrates a 14 x 14 direct connected to 75 K.W. Generator.

Send for our Bulletin giving guarantee etc.

## The Waterous Engine Works Co., Limited

BRANTFORD, - ONTARIO

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

## Noiseless Back Pressure Valve

The great improvement made during the past year in modern steam heating has created a demand for a high-class **Back Pressure Valve.**

Our **Improved Double Seated Valve** operates equally as well with eight ounces or five pounds back pressure.

Every valve is tested and the valve seats are **ground in under steam pressure.**

We carry in stock all sizes from 1¼ in. to 14 in.

*If interested write for Pamphlet "D"*

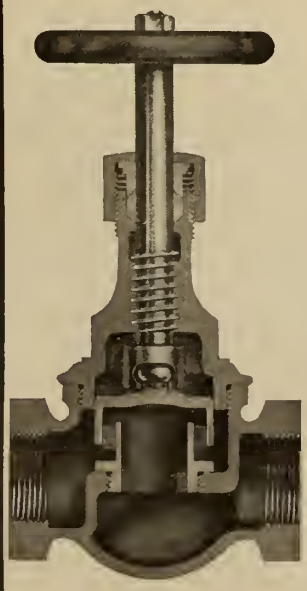
**DARLING BROTHERS, Limited**

Head Office and Works, 3-5 Ottawa St.

TORONTO MONTREAL WINNIPEG

# FREE

**ON 30 DAYS' TRIAL**



## "Standard-Crown" Globe and Check Valves

For Steam, Air, Water or Gas.
For any Pressure or Temperature.
Don't Leak.
Have Removable Seats.
Will Last for Years.
Require No Repairs.
Have No Soft Discs.
Can be Packed Under Pressure.
Have Full Discharge.
No Regrinding Machines Required.
Are fitted with Gland Followers.

**Canada's Highest Grade Valves**

We will send one or more valves to anycompany, or engineer writing on their company's letter head, free of charge on 30 days' trial. If not satisfactory we will take it back. It won't cost you a cent to try anyhow.

*Send Us a Trial Order or Write for Catalogue*

**The Standard Engineering Company**

43 Scott Street, Toronto, Can.

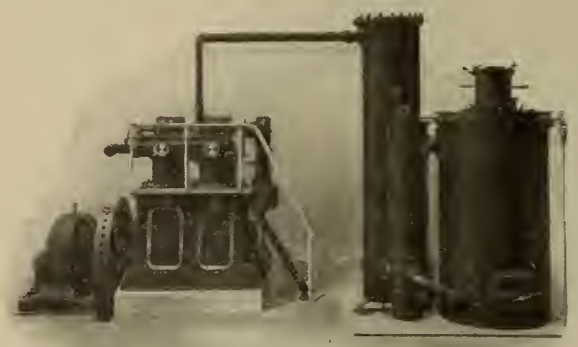
# Cheaper Than Steam——And As Reliable

That's the kind of power most progressive manufacturers are looking for. And we can prove to your absolute satisfaction that

# Warren Gas Power Plants

are every bit as reliable as the best types of steam engine, and far cheaper than any type of steam engine to operate. This claim is being proven day after day by more than 10,000 h.p. of Warren Engines operating within a few hours' travel of Toronto. No matter what kind of power you are using, it will pay you to send for our literature, which is vitally interesting to every power user.

*WRITE FOR IT TO-DAY*



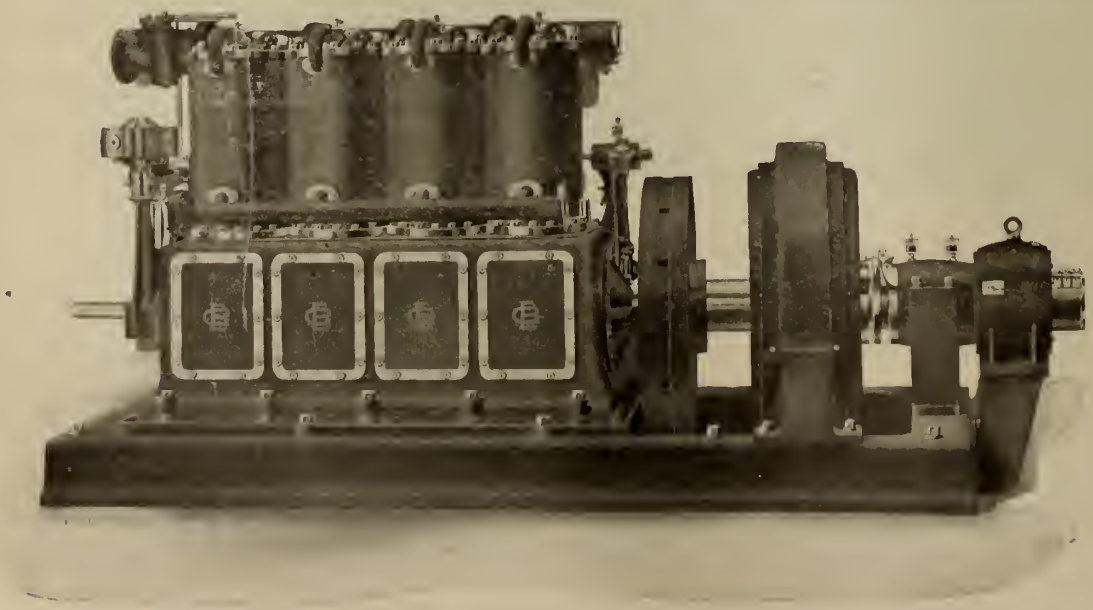
Cut shows the Warren Vertical Automatic Gas Engine and Suction Gas Producer, manufactured by the Struthers-Wells Co., Warren, Pennsylvania, in sizes to 300 h.p. Other equally efficient types, from 10 to 1,000 h.p.

## W. H. Oliver & Co.

Exclusive Sales Agents for the
Struthers-Wells Co., Warren, Pa.

M 509 McKinnon Building, Toronto

## Slow Speed Horizontal Gas Engines
## High Speed Vertical Gas Engines
## Suction Gas Plants Pressure Gas Plants



Engine direct connected to alternators, guaranteed to run in parallel successfully.

Complete plants equipped and erected, 10 to 1500 B.h.p.

*Prices and particulars from*

## THE GAS AND ELECTRIC POWER CO.

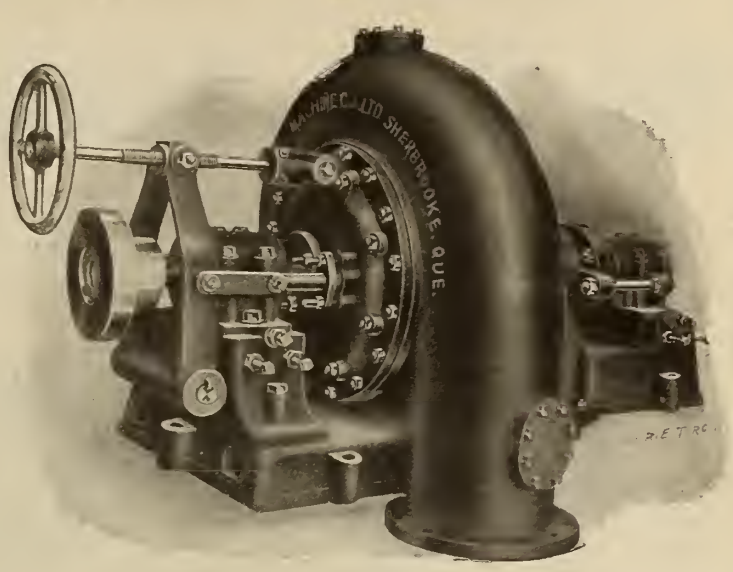
Stair Building, Bay Street - TORONTO

# Turbine Water Wheels

¶ From careful study and our large experience in water wheel building, we have evolved our New Improved Turbine.

¶ It is a good thing, and we want you to know all about it.

¶ A line to our nearest office will bring a catalogue and particulars.



## The Jenckes Machine Company, Limited

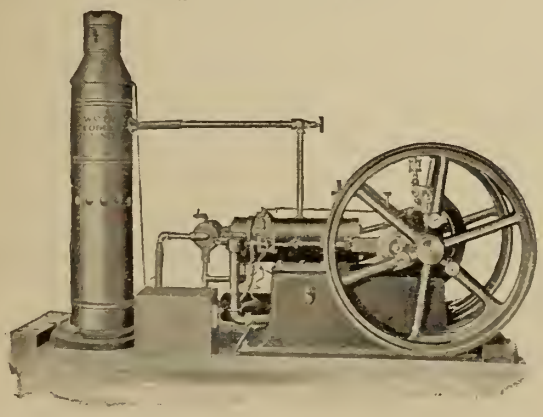
Sherbrooke Montreal St. Catharines Cobalt Vancouver

Works :

Sherbrooke, Que. ; St. Catharines, Ont.

# GAS and GASOLINE ENGINES

1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

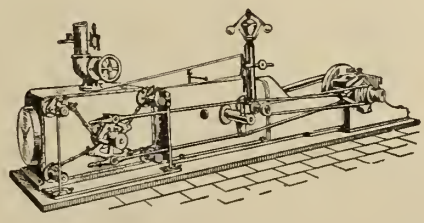
## Goold, Shapley & Muir Co.

Limited

BRANTFORD - CANADA

# ENGINES—

Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper



# BOILERS—

Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.

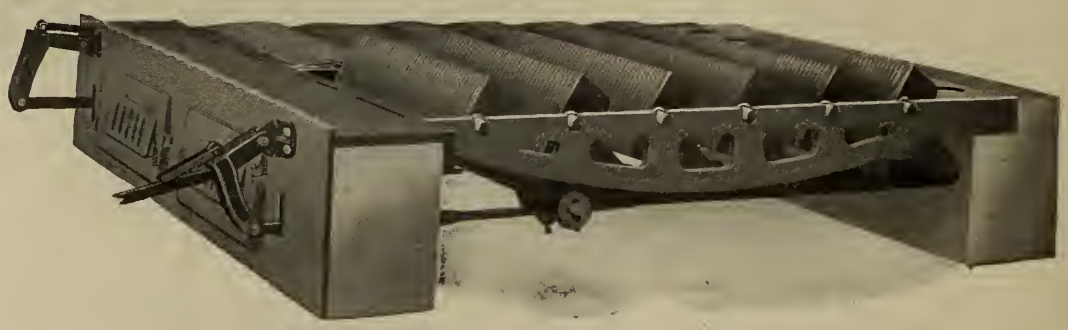
*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

LONDON, - ONT.

# New Model "Diamond" Shaking and Dumping Grate Bar

*By using Diamond Grates you increase your power from 5 to 20%*



*The Diamond Grate is applicable to any type of boiler and to units of any size.*

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal.

We guarantee that the Diamond Shaking and Dumping Grate Bar is superior to any other shaking bar in the market, as we control and are inventors of improvements which no other firm can use. The Diamond Bar makes for

**Economy in fuel**
**Ease of operation**
**Elimination of heavy clinkers**

Is thoroughly built by expert workmen in our own factory of the best material.

We further guarantee that these Bars are warranted not to be an infringement on any prior patents. We stand behind our customers and guarantee them in the unmolested use of our own invention.

***Boiler Setting and Repairs a Specialty***

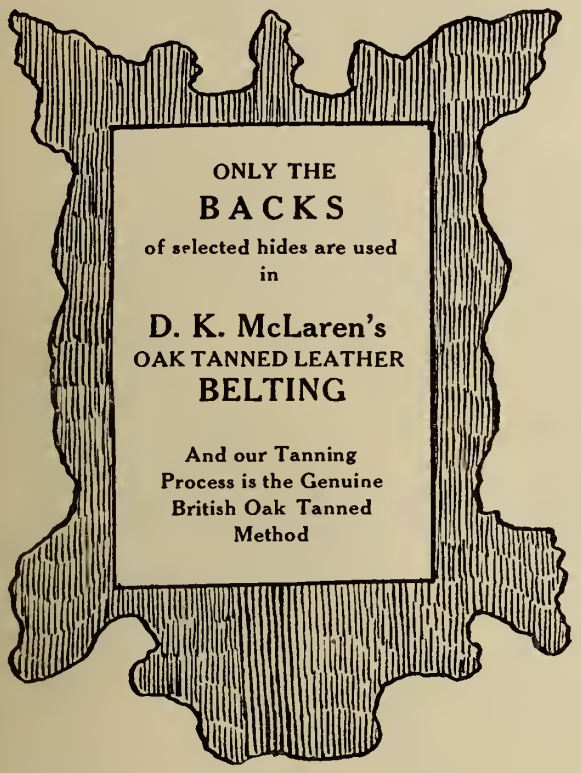
***Boiler Tubes, Either Welded or New, at Lowest Price***

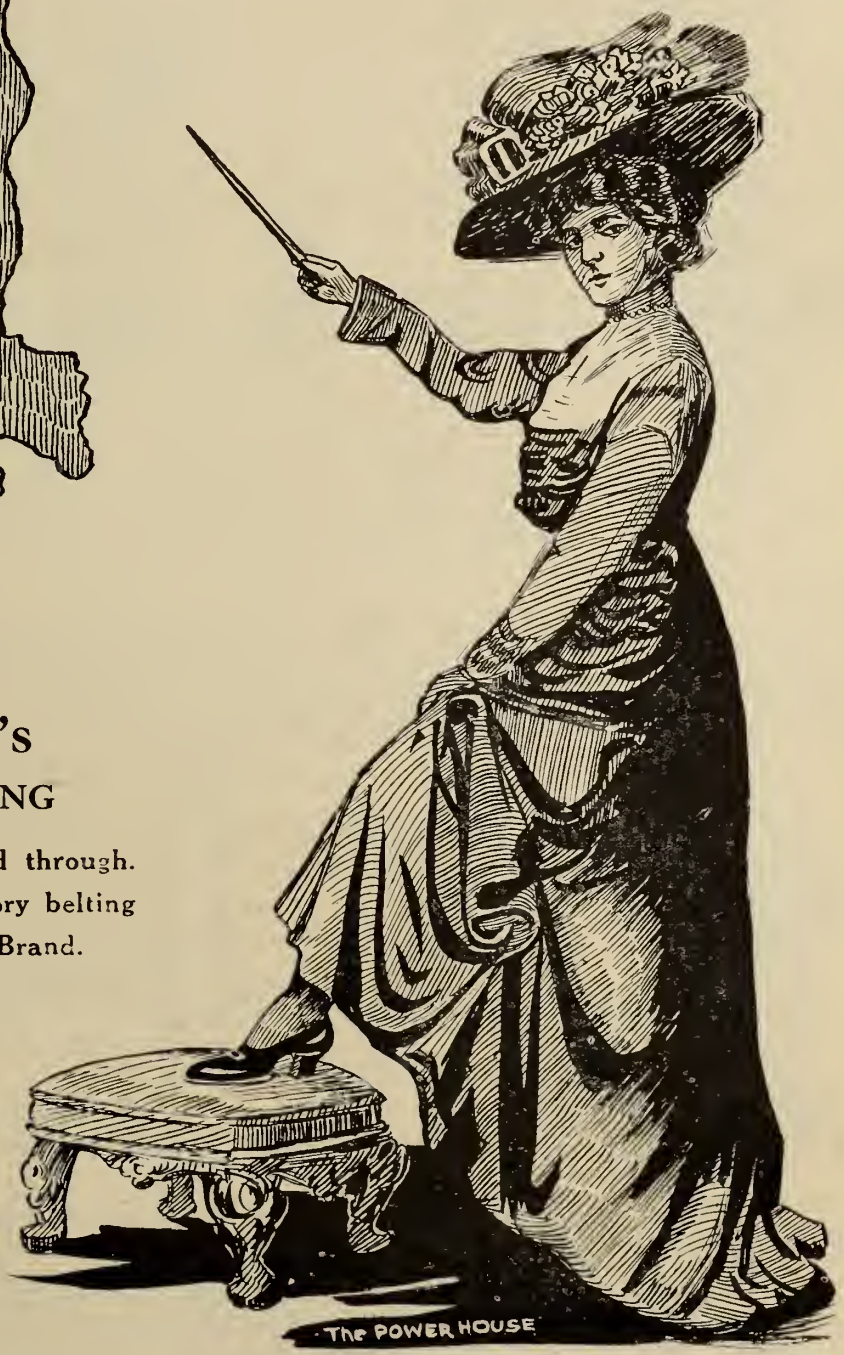
*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

## The DIAMOND GRATE BAR Company

Head Office and Factory, Berlin, Ont.

Branch Office, 118 St. James' Chambers, Toronto. Tel. M 1342




Every Inch of

## D. K. McLaren's

OAK LEATHER BELTING

is thoroughly reliable, through and through. If you want to know how satisfactory belting can be—just try the D. K. McLaren Brand.

REGULAR LINES

EXTRA "C"

AND

D. K. BALATA

Special Belts to Your Order

# D. K. McLAREN, LIMITED

**MONTREAL**
309-311 Craig Street West

**TORONTO**
200 King Street West

**QUEBEC**
21 St. Peter Street

**ST. JOHN, N.B.**
64 Prince William Street

**WINNIPEG**
Fred. J. C. Cox & Co., Representatives

**VANCOUVER**
418 Abbott Street

# MASON

Reducing Valves
Pump Pressure Regulators
Damper Regulators
Pump Speed Governors
Balanced Valves

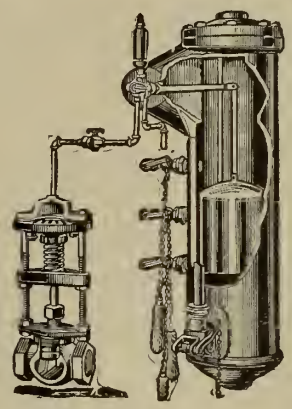
It is not what you pay for an article, but what the article pays you in return for its cost, that determines its value.

(Genuine)

# ASHTON

Pop Safety Valves
Pressure Gauges
Vacuum Gauges
Recording Gauges
"Ideal" Alarm Gauges

# Berry Boiler



# Feed Control

THE SIMPLEST AND BEST REGULATOR

WE ALSO SELL

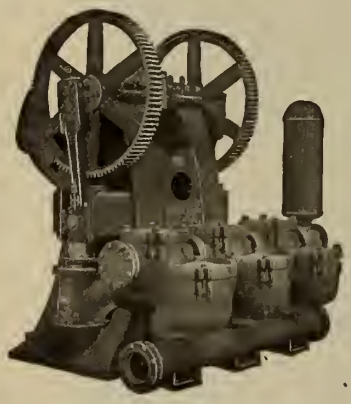
## BUNDY STEAM TRAPS

THE BEST FOR ALL SERVICES.

If your dealer cannot supply you, write to us for catalogues and full particulars.

## Peiler & MacKenzie,

52 ST. JAMES STREET
MONTREAL



## On Account

of their
Extremely Low Cost of
Operation and the Small
Amount of Attention
Required

# Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

## Goulds Pump Co.

Coristine Bldg., Montreal
Phone Main 1054

*Works - - - - - - Seneca Falls, N.Y.*

## VENETIAN GRATES

STEAM BLOWN

# Cheap Power

WITH

# Cheap Steam

Your boilers fired with cheap grades of fuel, with a saving of 15% to 60% in your fuel bills.

SMOKELESS COMBUSTION

WRITE US FOR PRICES AND PARTICULARS

## The Canada Gas Power & Fuel Co.

68 St. James St. West, Montreal

**Every Manufacturer Using a Steam Boiler Should Know** that **Tri-Sodium Phosphate** is the only chemical which will absolutely prevent **Scale** from forming in **Steam Boilers.**

# B-O-S-A-L-T

(Trade Mark)

IS THE

GUARANTEED BOILER CLEANER

Manufactured by

**The CANADA CHEMICAL MANUFACTURING COMPANY, Limited**

Executive Offices and Chemical Works: LONDON Warehouses: TORONTO and MONTREAL

# Don't Monkey

## with an Inferior Belt

Especially in Wet Places

The reasons are obvious: It is in wet, steam-filled places that belts undergo the hardest strains due to the working conditions.

ACME-WATERPROOF is a belting that is carefully made to work under the above trying conditions. : : : : : : : **FOR YOUR BEST INTERESTS SPECIFY ACME**

*Send for Price List*

## J. L. GOODHUE & CO.

DANVILLE, P.Q.

# OAK LEATHER BELTING

The prime factor in belt making is good hides. Our own agents gather the hides used in our belts from all parts of the world.

We use only the best parts (the centers) of the trimmed hides.

SADLER & HAWORTH

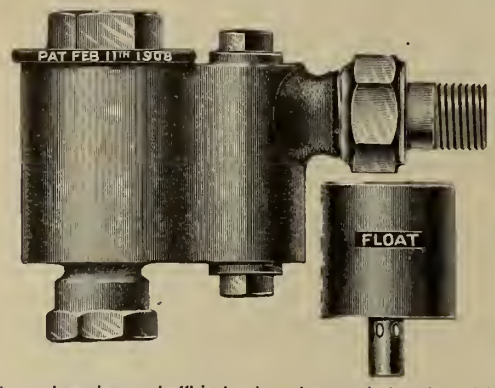
FACTORIES MONTREAL TORONTO

BRANCHES ST JOHN, N.B. WINNIPEG

BRANCHES CALGARY VANCOUVER

After choosing the hides it is important to have the very best tannage. We use the old-fashioned long method (taking five to six months), which is the only satisfactory way of tanning leather for belting. We fully guarantee our belting.

# VACUUM STEAM HEATING




The most popular, most efficient and most economical system of heating to-day is the Vacuum Steam System.

We have recently installed our Vacuum System in some very large buildings and factories, and it is giving the best of satisfaction, and saving fuel.

**A FEW FACTS REGARDING OUR AUTOMATIC VACUUM STEAM HEATING.**

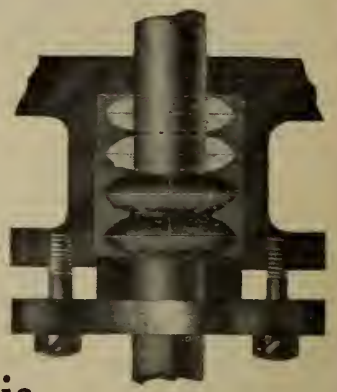
1—ECONOMY, by the elimination of BACK PRESSURE on engines supplying the exhaust.
2—Does away with water hammer or pounding in piping, and water logging of radiators by exhausting all water.
3—Does away with air binding in radiators as the air is exhausted.
4—Permits a modulated or regulated heat in rooms, higher temperatures and increased efficiency of dryers, dry kilns, blast heater coil stacks, paper cylinders, etc., by removing water of condensation.

By the use of this system, you can utilize the exhaust steam to heat your buildings with, which otherwise would go to waste.

***A post card will bring circular fully describing our Vacuum System.***

**THE CANADIAN STEAM BOILER EQUIPMENT CO., Ltd.**
36-38 Lombard Street, Toronto

# THE Packing That Stays Packed



# is The Rhodes Improved Metallic Packing

For EVERY service of rod packing and ESPECIALLY ADAPTED FOR AMMONIA.

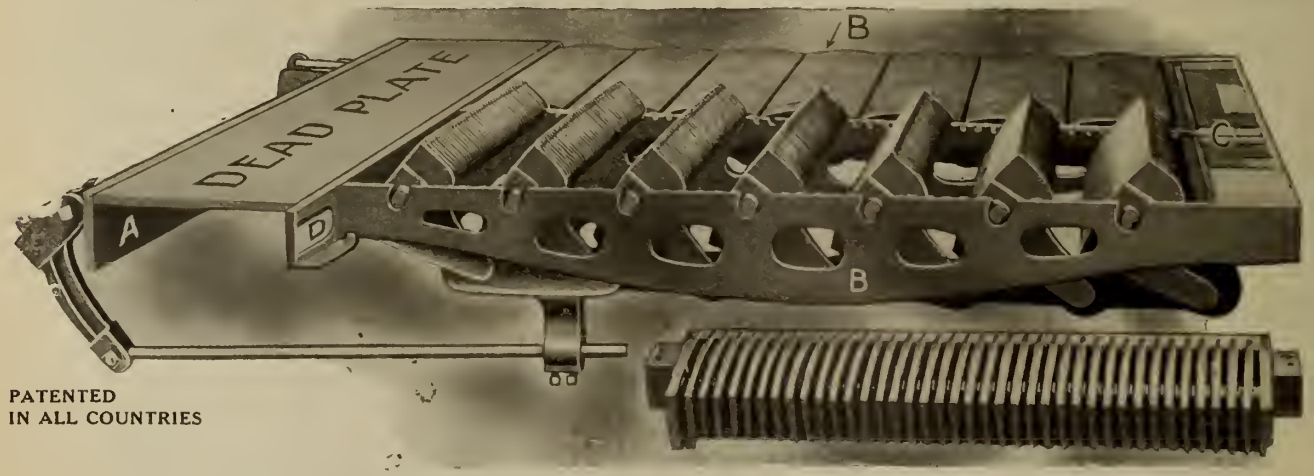
GUARANTEED!!

Write for Prices and list of Happy Users.

AGENTS WANTED

**The Rhodes Improved Metallic Pkg. Co.**
11 St. Nicholas St., Montreal Limited

# The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES

We have recently improved the Cyclone Grate, adding three most important features to it, which increases its fuel-saving qualities and the life of the bar, also making it shake more easily.

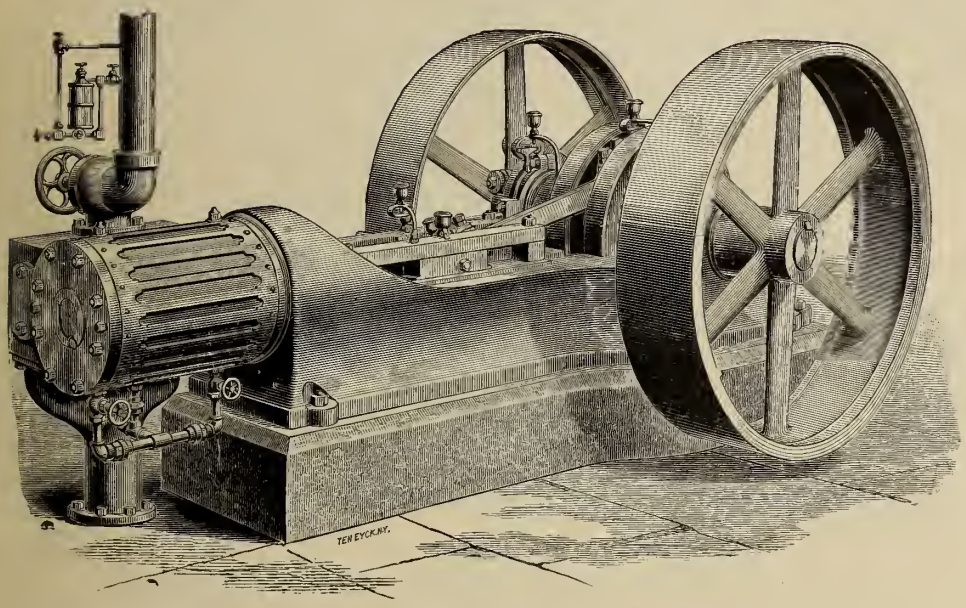
Guaranteed to evaporate more water per pound of coal than any other device—or in other words, will give you more steam, ton for ton, than any other grate bar or stoker manufactured.
Will save you from 10 to 20 per cent. of your fuel bill—guaranteed to last at least twice as long as any bar on the market. In fact our bar is now practically everlasting. Saves the labor and annoyances of the fireman very materially.

See particulars of improvements recently made in our bar in the editorial section of this issue of The Power House.

***Write for Circular and Full Particulars***

**Canadian Steam Boiler Equipment Company, Limited**
36 and 38 Lombard Street : : : : : : : : : : Toronto

# Power Equipment



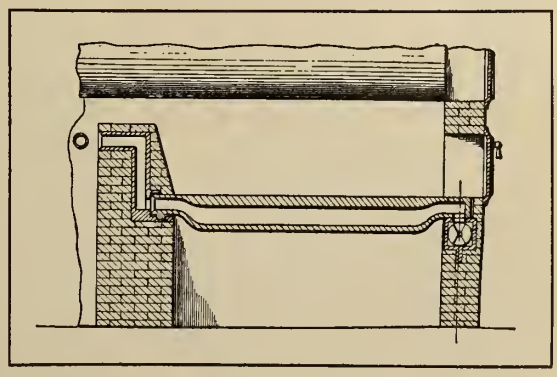
Automatic Engines
Horizontal Engines
Marine Engines
Vertical Engines
Fire Box Boilers
Horizontal Boilers
Marine Boilers
Vertical Boilers
Hoisting Engines
Gasoline Engines
Electric Motors
Water Wheels

Our supply catalogue or machinery stock list for the asking

## H. W. PETRIE, Limited

TORONTO MONTREAL VANCOUVER

# Fleming Grate Bars



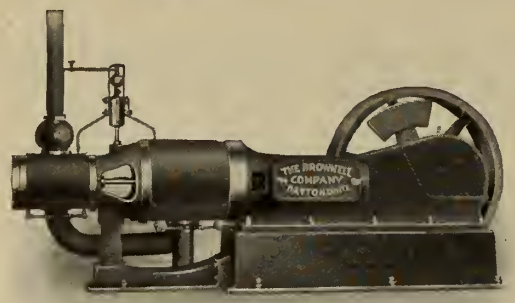
An examination of this cut will give some idea of the scientific principle upon which Fleming Grate Bars are constructed. The natural draft entering the **AIR COMBUSTION CHAMBER** causes a continuous passage of air through the grate bars, over the bridge wall and into the combustion chamber, where, now heated to a temperature of 600° F., it unites with the unused carbon, causing a further combustion and a consequent increase in heat units. The never-ceasing current of air, passing through the bars, keeps them comparatively cool, thus preventing the adherence of clinkers as well as insuring them a life which is practically perpetual. In addition to the economy in fuel consumption there will be a proportionate decrease in the labor of cleaning, in the expense of renewing grates—to say nothing of the decrease in smoke.

**It means** that with Fleming Grate Bars under your boiler you save from TEN to TWENTY DOLLARS on every hundred dollars worth of fuel you buy.

WRITE FOR BOOKLET.

## BUTTERWORTH FOUNDRY, LIMITED

53 QUEEN STREET, - OTTAWA, - ONTARIO



**The Brownell Company**

Dayton, - Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

"Dart's Pat."

**UNIONS AND FLANGES**

GUARANTEED

**NOT TO LEAK**

THEREFORE

**REQUIRE NO ATTENTION**

Think what this means to you in a moneyed way

**DART UNION CO., Limited**

**Manufacturers** **TORONTO**

# BEST BY TEST

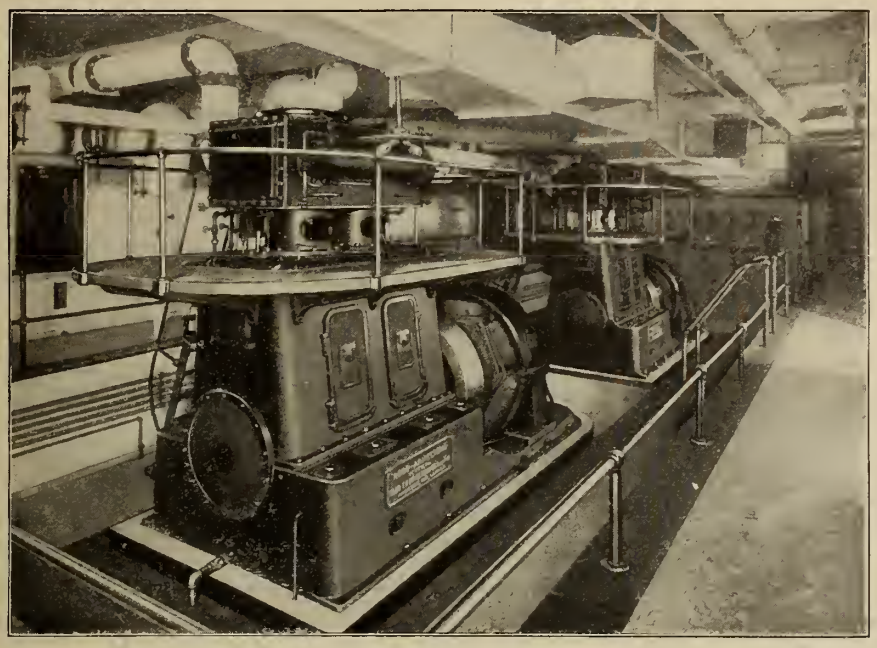
**HARRIS**
Heavy Pressure
**Bearing METAL**

Best for All Machinery Bearings

Manufactured and Guaranteed by

**The Canada Metal Company, Ltd.**

TORONTO, ONTARIO



# HIGH SPEED VERTICAL ENGINES

of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES { Traders Bank Building, TORONTO; Wm. McKay, Manager.
Bell Telephone Building, MONTREAL; Watson Jack, Manager.
Union Bank Building, WINNIPEG; J. F. Porter, Manager

We Guarantee that the

## Triumph Turbine

will furnish more power according to diameter, and give greater efficiency at all stages of gate opening than any other turbine on the market. The cut shows our standard style with vertical shaft. The runner is a single downward discharge, conical in shape, and the buckets are wrought steel with cast iron band around outside. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

*SEND FOR CATALOGUE*

## The Madison Williams Mfg. Co., Ltd., Lindsay, Ontario, Can.

# Heavy Duty Goldie
## Corliss Steam Engines

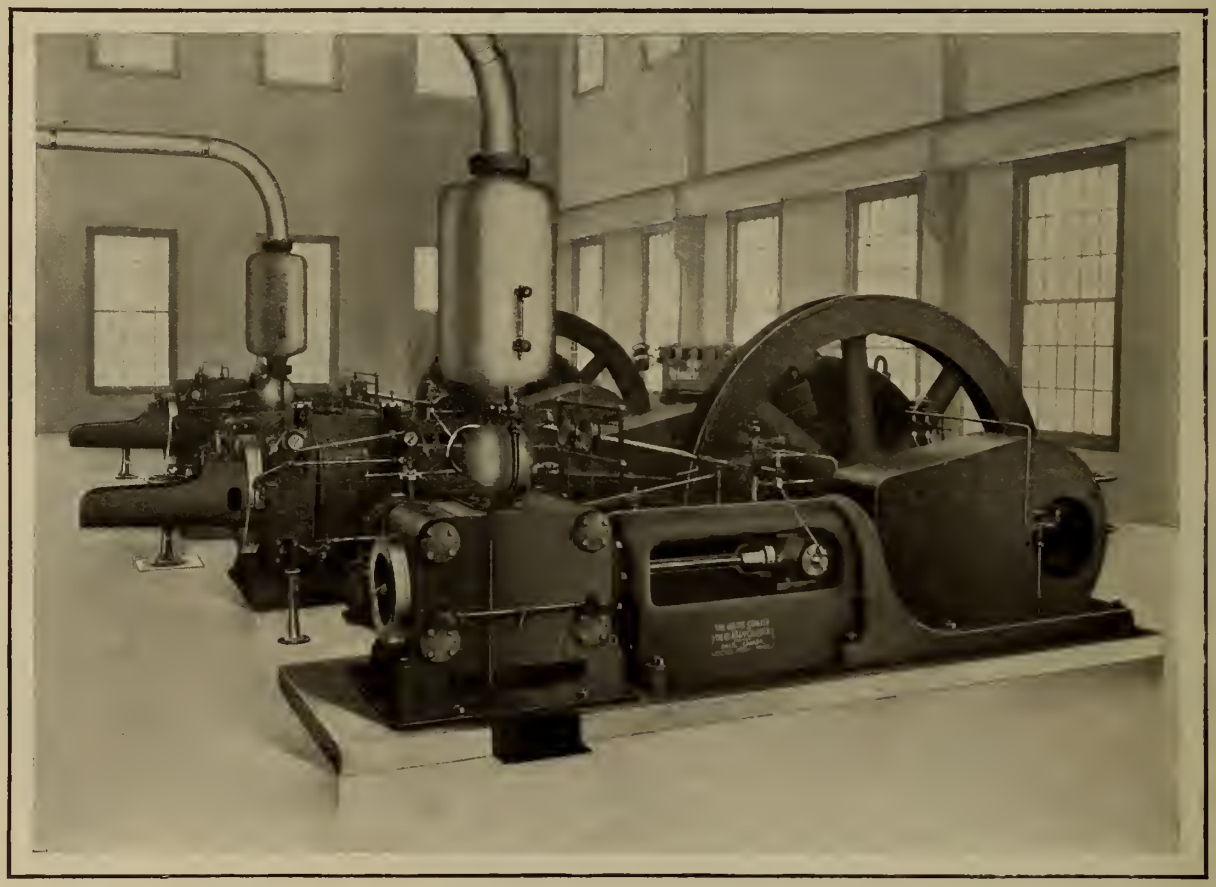


Illustration shows the Power House of the new Grand Trunk Railway Shops at Stratford, Ont., equipped with two Cross Compound Goldie Corliss Engines, direct connected.

## The Goldie & McCulloch Co., Ltd.
### Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B.C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Boilers, Special Tanks, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

ASK FOR CATALOGUES, PRICES AND ALL INFORMATION.

# The Practical Side of Work at a Canadian University

## Besides Book Learning, Students have Instruction and Practice in Construction and Erection of Power Machinery, etc.—A Description of the Thermodynamic and Electrical Laboratories.

By F. C. D. WILKES, B.Sc.

In view of the increasing attention that is being given to technical education as an adjunct to practical work in manufacturing plants it will be interesting to note briefly what is being done regarding practical work as an adjunct to our large technical institutions.

It is not all grind and book learning at our Canadian universities; the men that are turned out from the engineering courses have other knowledge of their friends, the engines, dynamos and accessories, beyond that which they take from books and lectures. Much money has been spent in fitting up workshops and laboratories with practical, up-to-date machinery, tools and equipment for making practical and commercially useful tests. As a good example of the progress this work is attaining a description of the workshops and laboratories at McGill University, Montreal, should prove interesting.

### The Macdonald Engineering Building.

The engineering building is a fine example of modern construction, being made as absolutely fire-proof as is possible. Throughout there is not an ounce of inflammable material where it has been at all possible to eliminate it. The floors and stairways are all of reinforced concrete and steel; the lockers are all steel; the automatic fire-doors are of metal, and the whole interior is subdivided by heavy fire-proof walls.

The mechanical and electrical laboratories are on the ground floor of this building, and average 23 feet in height. The Workman building adjoins the engineering building, and therein are the pattern, carpenter, machine and smith shops and the foundry.

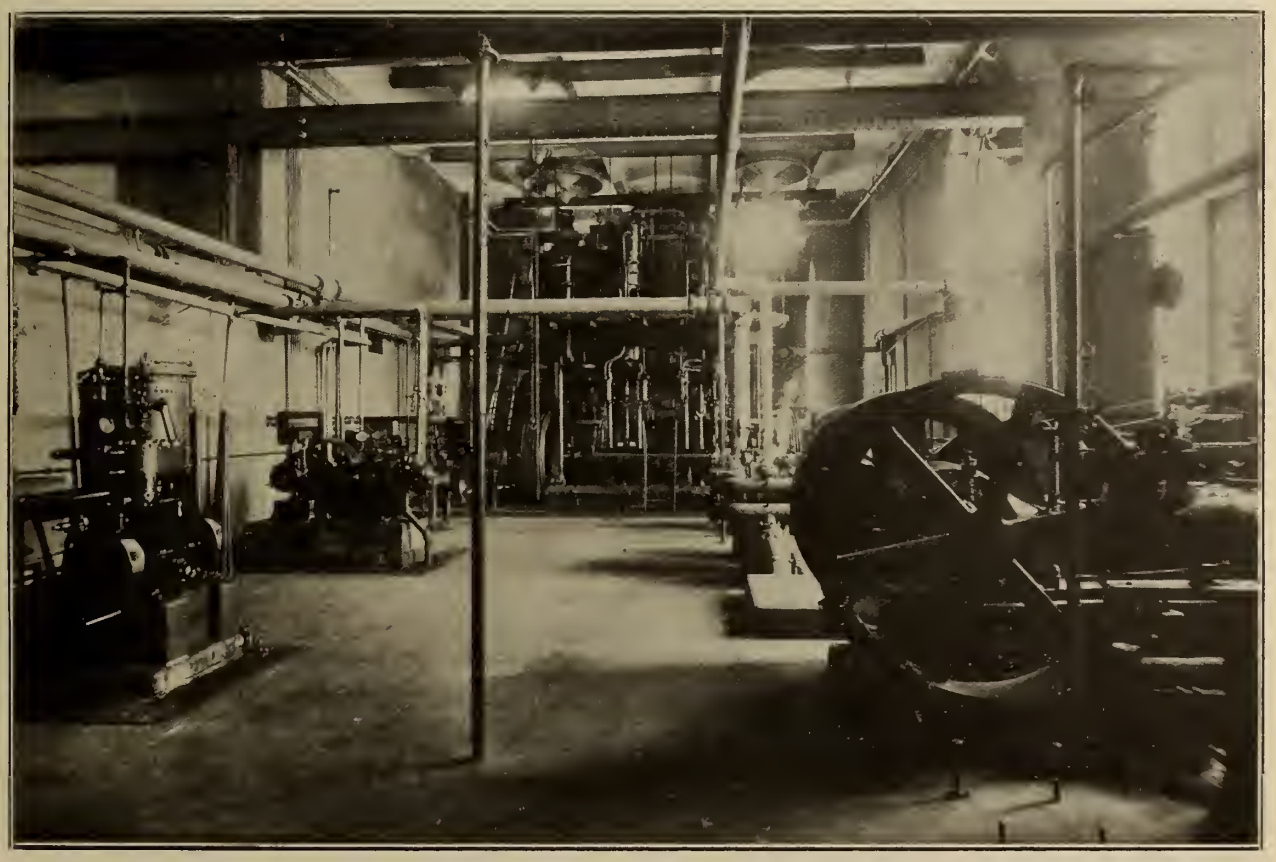


Fig. 1.—Thermodynamic Laboratory—This Laboratory contains steam engines of various types, compressors, etc.—That at the end of the room is a 120-horse-power engine arranged so that it may be worked as a simple, compound, triple or quadruple expansion engine, either condensing or non-condensing.

### Thermodynamic Laboratories.

In the steam laboratory, Fig. 1, tests of engines, air compressors, etc., are made, and the student gets a good training in the working of prime movers. The largest unit is the one seen at the back of Fig. 1. This is a 120 h.p. vertical engine, especially designed for investigating the behavior of steam under various conditions. The cylinders are 6½, 9, 13 and 18 inches in diameter, by 15-inch stroke. These are so connected as to allow of working as a simple, compound, triple or quadruple expansion engine, either condensing or non-condensing, and with any rate of expansion desired. The jackets are so fitted as to permit of measuring independently the water condensed in the cover, barrel or bottom jacket of each cylinder. The engine can be worked with any desired initial pressure up to 200 pounds per square inch. The measurements of heat are made by means of large tanks which receive the cooling water and the condensed steam. There is an independent

surface condenser and air pump and the arrangement of tanks and scales is very convenient, permitting very accurate work to be done. The power of the engine is absorbed and measured by means of two Froude hydraulic absorption brakes and an alternative friction brake.

The other machinery in the laboratory includes the following: A Robb automatic cut-off engine, having a cylinder 10½x12 inches. This engine is especially fitted up for the measurement of cylinder temperatures and can be run at speeds up to 200 r.p.m., the power being absorbed by a friction brake. Connected to this engine is a Wheeler condenser having a surface of 200 square feet. This is also fitted up for special work.

A McIntosh-Seymour high-speed automatic engine, 12x12½ inches, is connected to an air compressor through a chain drive. This engine is fitted with an automatic recording apparatus for registering the load on the brake. The compressor, which was designed and built in the University workshops by third and fourth year students, is a two-stage machine, taking 40 h.p. and having cylinders 10 and 17x15 inches. The compressor discharges into reservoirs placed under the floor of the machine shop and is provided with an intercooler, whose capacity can be varied as desired.

There is an 8x9-inch Leonard horizontal engine especially fitted for instructional work in valve setting, provided with an independent surface condenser; a standard 9½-inch Westinghouse air brake pump, fitted for testing and for supplying compressed air for experimental and other purposes; a Blake non-rotative steam pump with cylinders 4½ and 2¾x4½ inches,; a vertical compound engine, 3 and 5½ x 3¾ inches (seen in the left foreground of Fig. 1), which was also designed and built in the workshops by the students.

### Gas Engine Laboratory.

This is provided with apparatus that is especially arranged for exhaustive tests in the working of gas engines and accessories. The equipment includes: A horizontal gas engine of 40 h.p., supplied by the National Gas Engine Co., having a cylinder 12x20 inches; a suction-type producer for the above, with all the necessary scrubbers and cleaning apparatus; a down-draft producer, designed for working with lignite and bituminous coal; a standard 4-inch gas meter, gasometer and exhauster; an Atkinson gas engine of 6 h.p. working on city gas; an Otto type gas engine, cylinder 8½x12 inches, built in the University workshops for city gas; a two-cylinder 4 cycle gasolene automobile engine of 8 h.p., also built in the University workshops.

Fig. 2.—The Alternating Current Laboratory—The Laboratory is fitted with Alternating Current Generators of different Makes, Driven by Direct Current Motors. Sixteen Alternating Current Machines, Including Single, Two and Three Phase Generators, Synchronous motors, Synchronous Converters, Together with Stationary and Rotary Induction Apparatus are Provided. The Machines are so Arranged that they can readily be Moved by Means of the Electric Traveling Over-head Crane, which is Seen in the Picture to be Bringing a Machine up the Laboratory. Dean Adams and Professor Herdt are Standing on the Right.

The smaller apparatus belonging to the laboratories includes the necessary equipment of weighing machines, brakes, calorimeters, thermometers, gauges, pyrometers, fuel testers, indicators, planimeters and a Moscrop recorder.

### Boiler Instalation.

This is the one that supplies steam for heating and power purposes and is so arranged as to be available for experimental work and tests in connection

with the work in the thermodynamic laboratories. The students run off about four complete 12-hour tests and get good instruction in boiler work. The equipment includes one Cornish boiler for heating service, rated at 50 h.p.; one loco-boiler of the Belpaire type, rated 100 h.p.; one Robb-Mumford internally fired tubular boiler, rated 120 h.p.; two Babcock-Wilcox water tube boilers, each rated 60 h.p.; one Yarrow water tube marine boiler, fitted in a closed stokehole, for working under forced draft, rated at 150 h.p. These boilers are all provided with the necessary tanks, weighing machines and apparatus for carrying out evaporative tests.

**Alternating Current Laboratory.**

In this laboratory (Fig. 2), which is situated on the ground floor of the engineering building, all dynamos are motor-driven. Speed regulation is attained either by varying the voltage supply to the motor or by varying the motor field current. Power is obtained from three independent sources of supply, two 75 k. w. d.c. direct connected units in the main service plant and one 300 k.w. hour storage battery. All generators and motors are mounted on strong testing benches of different heights, with plotted floors, so that any machine when placed on a bench, may be quickly secured in any desired position. These benches are supported on longitudinal slotted rails and may be removed to any position in the laboratory and there bolted to the rail. An overhead 3-motor electric traveling crane permits of rapid and easy transference of machines. All wiring is done below the floor level in passages provided for the purpose and special switchboards are provided for current distribution. The starting resistances are placed in concrete compartments. Special testing tables fitted with switches, circuit breakers, etc., facilitate the work.

Sixteen alternating current machines, including single, two. and three-phase generators, synchronous motors, synchronous converters, together with stationary and rotary induction apparatus, are provided for alternating current work. Large variation of wave form may be obtained by use of specially shaped inductors and field poles. Induction motors with wire wound rotors serve as induction generators and frequency changers. The laboratory is likewise provided with about 100 volt meters, ammeters and watt meters of standard make and of different ranges; also speed indicators, condensors, rheostats, standard resistances, etc.

This laboratory (Fig. 3), situated on the second floor of the Workman building, is similar in design to the alternating current laboratory, all generators being motor-driven and mounted on convenient benches and similarly supplied with power. Two hand-operated traveling cranes serve these machines. The laboratory is equipped with 28 or 30 commutating machines; constant potential generators of various types; shunt, series and compound wound motors; variable speed interpolar motors, boosters, dynamotors, closed and open coil constant current machines of many different makes varying in capacity to 40 kilowatts. Some 75 voltmeters and ammeters are also provided, as well as the usual accompaniments of starting boxes, controllers, rheostats for absorbing power, etc.

Fig. 3.—Direct Current Laboratory.—All Engineering Students Work in this Laboratory, where Instruction is Given in the Operation of Various Types of Motors and Generators, as well as in the Control and Standardizing of Electrical Instruments.

The above description will serve to show that the student gets a good deal more than book learning at a university, and finishes with a good ground knowledge, at any rate, of the different types of machines and their uses.

For the photographs we are indebted to the courtesy of the Montreal Standard.

# Course of Lessons for the Instruction of Stationary Engineers

Sixth of a Series of Interesting Educational Articles—This Article Contains Problems which are Fully Worked Out and Answers Given.

By W. A. CROCKETT

**Properties of Saturated Steam.**

To those who have no knowledge of logarithms, the best way is to consult a steam table. There are quite a few of the tables printed and they vary somewhat, although the results are approximately correct.

The loss of heat from the steam=the gain of heat by the water.

The heat given up by 1 lb. of steam= $H-(t_1-32)$.

$$X=\frac{1115+.3\times212-100}{100-60}$$

$$X=\frac{(1115+63.6)-100}{40}$$

$$X=\frac{1178.6-100}{40}$$

$$X=\frac{1078.6}{40}=26{,}965 \text{ lbs.}$$

I. is from Peabody's table.

| Abs. | Press in lbs. per sq. in. | temp. in F. | Total heat units from water at 32 deg. | Total latent heat | Weight. in lbs per cu. ft. |
|---|---|---|---|---|---|
| I ..... ..... | 1 | 101.99 | 1113.1 | 1043.01 | .00299 |
| II. ..... ..... .... | 1 | 102.01 | 1113.05 | 1043.01 | .00302 |
| I ..... ... ..... | 5 | 162.34 | 1113.5 | 1000.8 | .01366 |
| II ... ..... ..... | 5 | 162.37 | 1131.4 | 1000.899 | .01378 |
| I ... ..... ..... | 10 | 193.25 | 1140.9 | 979. | .02621 |
| II ..... ... ..... | 10 | 193.28 | 1140.89 | 979.23 | .02643 |
| I ..... ... ... ... | 14.69 | 212. | 1146.6 | 966.6 | .03772 |
| II ... ... ... ..... | 14.7 | 212. | 1146.6 | 966.06 | .03792 |
| I ... ... ..... .. | 15 | 213.03 | 1146.9 | 965.1 | .03826 |
| II ..... ... ..... | 15 | 213.06 | 1146.926 | 965.318 | .03868 |
| I ..... ... .... .. | 20 | 227.95 | 1151.5 | 954.6 | .05023 |
| II ..... ..... .... | 20 | 227.96 | 1151.46 | 954.81 | .05069 |
| I ..... ... ... ... | 30 | 250.27 | 1158.3 | 938.9 | .07360 |
| II ..... ..... ..... | 30 | 250.29 | 1158.28 | 939.01 | .07420 |
| I ..... ... ... ... | 40 | 267.13 | 1163.4 | 927.0 | .09644 |
| II ..... ... ... .... | 40 | 267.16 | 1163.4 | 927. | .09723 |
| I ..... ... ... .... | 50 | 280.85 | 1167.6 | 917.4 | .1188 |
| II ..... ... ... ... | 50 | 280.9 | 1167.6 | 917.26 | .1199 |
| I ..... ... ..... | 100 | 327.58 | 1181.9 | 884. | .2271 |
| II ..... ... ..... | 100 | 327.62 | 1181.86 | 883.77 | .2302 |

The heat gained by X lbs. of water= $X(t_3-t_2)$ where

H=total heat calculated from 32 deg. F.

$t_1$=temperature of steam.

$t_2$=temperature of water.

$t_3$=resulting temperature.

x=lbs. of water at $t_2$.

Therefore,

$H-(t_2-32)=X(t_3-t_2)$, but $H=1083+.3t$, therefore $1083+.3t-(t_3-32)=X(t_3-t_2)$

$$X=\frac{1115+.3t_1-t_3}{t_3-t_2}$$

**Problem 12.**

If 1 lb. of steam at 212 deg. F. be mixed with X lbs. of water at 60 deg. F. what is the value of X when the resulting temperature is 100 deg. F.?

$$X=\frac{1115+.3\times212-100}{100-60}$$

$$X=\frac{(1115+63.6)-100}{40}$$

$$X=\frac{1178.6-100}{40}$$

$$X=\frac{1078.6}{40}=26{,}965 \text{ lbs.}$$

**Problem 13.**

How many pounds of steam at 50 lbs. pressure absolute are required to raise the temperature of 200 pounds of water from 40 deg. to 130 deg. F. the water and steam being mixed together?

130—40=90 B.T.U. required to raise one lb.

200 lbs. from 40 deg. to 130 deg., requires $90\times200=18{,}000$ B.T.U.

One pound of steam at 50 lbs. pressure gives up in condensing its latent heat of vaporization or 917.2 B.T.U. In addition to this each lb. of condensed steam gives up an additional amount of heat in falling to 130 deg. The temperature is 280,904 deg.. Each lb. gives up by its drop in temperature 280,904 deg. —130=150.904 B.T.U.. therefore each lb. of steam drops 917.2+150.904=1068.104 B.T.U., therefore it will take $\frac{18000}{1068.104}=$ 16.85 lbs, of steam.

**Problem 14.**

Steam enters the condenser at a temperature of 142 deg. F. to be condensed into water at 120 deg. F.; the circulating water enters at 60 deg. F. and is discharged at 100 deg. F.; find how many pounds of circulating water will be required per lb. of steam.

$$X=\frac{1115+.3\times142-120}{100-60}$$

$$X=\frac{1115+42.6-120}{100-60}$$

$$X=\frac{1157.6-120}{40}$$

$$X=\frac{1037.6}{40}=25.94 \text{ lbs. Ans.}$$

**Problem 15.**

How many B.T.U. are required to raise 6 pounds of super-heated steam from 78 lbs. pressure absolute to 121 lbs, pressure absolute?

Specific heat of super-heated steam is .48, therefore to raise 1 lb. of super-heated steam from 78 lbs. pressure absolute 310 deg. F. to 121 lbs. pressure absolute, 342 deg. F. requires $48\times(342-310)=.48\times32=15.36$ B.T.U. to raise 6 pounds through the same range of temperature requires $15.36\times6=92.16$ B.T.U. Ans.

**Formula (3).**

$$H.P.=\frac{PWV}{33000y}$$ where

H.P.=horsepower.

W=Weight of fuel burned per minute.

V=volume of air per pound of fuel in cubic feet.

P=pressure of draft in pounds per square foot.

Y=efficiency of draft apparatus..

Formula 3 shows the H.P. necessary to furnish a forced draft. The pressure of a forced draft is measured in inches of water, an inch of water corresponding to a pressure of .036 pounds per sq. inch, or about 5.2 pounds per square foot.

**Problem 16.**

What H.P. is needed to supply air at a pressure of 2 inches of water to a total grate area of 120 square feet burning 50 lbs. of coal per square foot per hour, and requiring 234 cubic feet of air per pound of coal? Efficiency 80 per cent.

$$H.P. = \frac{2 \times 5.2 \times \frac{50}{80} \times 120 \times 234}{33000 \times .80}$$

$$H.P. = \frac{10.4 \times \frac{50}{80} \times 120 \times 234}{26400}$$

$$H.P. = \frac{6.5 \times 234}{220} = \frac{1521}{220}$$

$$H.P. = \frac{1521}{220} = 6.9$$

H.P.=6.9. Ans.

# The Ice Jam at Niagara Does Considerable Damage

## Hydro-Electric Power Plant of Ontario Power Co. was Flooded, Shutting Down Machinery for Several Days - Opening the River with Dynamite.

During the week of April 19 to 24 the Niagara River presented a unique sight. The ice was packed in solidly from the Whirlpool to Niagara-on-the-lake. This is a stretch of seven miles, and the depth of the water at some points of the river is about 200 feet.

The conditions producing the stupendous jam of ice in the Niagara gorge were the high water in the upper river carrying large quantities of ice over the falls, and the heavy winds blowing up the Niagara gorge and holding the ice back in the lower river. The vast quantities of ice which passed over the falls and through the rapids and whirlpool became wedged against the banks and shoals at Lewiston, forming a dam which raised the level of the water 40 or 50 feet above the normal and 20 to 25 feet higher than ever before recorded, and piling the ice so high that a person standing on the ice could touch the under side of the Lewiston Bridge.

### Power Companies Suffer.

The water entered the windows and doors of the hydro-electric power plant of the Ontario Power Co., completely shutting down the machinery for several days. The high-tension generators were partly submerged, and although the damage to the plant was not permanent, the electrical machinery was put out of commission, so that the power service on both the U. S. and Canadian side was discontinued for a time.

Arrangements were made for a high-tension current supply from the other Canadian power plants above the falls for temporarily supplying the Canadian power users. On the U. S. side the 10,000-horse-power gas engine power plant of the Lackawanna Steel Co. was utilized for operating the Buffalo and Hamburg Electric Railway, and for supplying the other power users of the Ontario Power Co. between Niagara Falls and Rochester.

Ice was piled up fifty feet high, the Great Gorge Electric Railway on the U. S. side was buried twenty feet under the ice and trolley lines and tracks were wrecked. Great damage was also done to the Niagara Gorge Electric Railway at the whirlpool rapids and great havoc resulted along the shores from Niagara Falls to Lewiston.

Conditions became so bad that dynamiting the ice was resorted to under the supervision of Engineer Henry A. Kuntz and Charles Tuttle, the latter having direct charge of the blasts. The last charge was exploded on April 24, and consisted of a pile of 2,150 lbs. of dynamite. The explosions were spectacular and tossed ice, water and sticks of timber high into the air, cracking off ice in large quantities. The relief work cost about $2,000. The six tons of dynamite, five of which were exploded cost $2,160.

On April 25 a northwest squall followed by an even more energetic southwest gale, cleared the Canadian channel at the mouth of the Niagara River and broadened the passage torn out by dynamite along the American shore of the stream and viciously ripped away the lower end of the ice pack. The power companies at the falls are now transmitting power as before the ice jam and flood, the necessary repairs having been made.

Fig. 1.—Ice was Piled 50 feet High in Front of the Falls.

Fig. 2.—Ontario Power House was Affected.

## ELECTRICITY BY WIND POWER.

An interesting demonstration was recently given in England of an electric-generating plant operated by a windmill. The wind wheel was 16 feet in diameter and was mounted on a tower of 50 feet height. Three tails were provided, one at the side being fixed, and the other two adapted to be rotated on a horizontal axis, so that when they were turned into the vertical plane they would hold the wheel into the wind, and when turned in the horizontal plane, the fixed tail would throw the plane of the wheel in the plane of the wind. The two movable tails were arranged to swing out of the vertical position, automatically, when the velocity of the wind rose above a certain amount. A two-kilowatt generator was driven by the wheel at speeds varying from 800 to 1,600 revolutions per minute.—Scientific American.

# Tungsten Lamps for Alternating and Direct Current

### A Practical Treatise Showing the Application, Characteristics, Efficiency, Life and Performance of Tungsten Filament Lamps.

The successful development of the tungsten lamp is one of the most important achievements in the history of electric lighting, and the rapid introduction of these lamps into general use is significant of their advantages. A short time ago the tungsten lamp was only a promising laboratory experiment, but its improvement has been very rapid, so that at present it possesses many good points, particularly in the quality of its light and the economy with which the light is produced.

Tungsten lamps are produced in a number of different sizes and styles. These lamps are similar in general appearance to the carbon filament lamps and are furnished in several capacities in standard lamps. These lamps have the remarkable efficiency of 1¼ watts per candle-power.

The tungsten lamp emits a light of very superior color and quality which closely resembles pure daylight. The whiteness of its light, due to the extremely high temperature at which the filament operates, has alone been sufficient to bring the tungsten lamp into high favor.

Tungsten is one of the rare metals and is found in various ores in combination with other metals. It is extremely hard and its melting point is 750 degrees C. This makes it an especially suitable material for lamp filaments. Its specific resistance is low, so that a considerable length of filament is required in 100-128-volt lamps, but its resistance increases with increase of temperature and therefore the current does not vary with the change in voltage in the same degree as in the carbon filament.

Tungsten lamps have an equally long life when burned on either direct or alternating current circuits. The 25-watt lamp which gives about 20 candle-power, comes nearest to the standard 16-candle-power lamp in size and can be used advantageously to replace the latter, and it is claimed that it gives 25 per cent. more light and requires less than half the current consumed by the standard carbon lamp. The 40, 60 and 100-watt lamps provide for various intensities of illumination as may be desired, and they may also be substituted for 2, 3 and 5-light clusters respectively, giving a good general illumination with a low current consumption.

#### Characteristics.

The three most important characteristics of the tungsten lamp are its high efficiency, long life and uniform brilliancy throughout its life. These features combine to make the tungsten lamp one of the most economical electric lighting units ever produced. The reduced current consumption per candle-power of these lamps is equally advantageous to both the consumer and the central station, as it reduces the monthly bills of the former and enables the latter to take on a large number of new customers without providing an increase in generator or feeder capacity.

A further and highly important advantage of the tungsten lamp to the central station is that it enables the latter to compete with gas lighting on the basis of cost. In every central station territory there is a large percentage of

Westinghouse 25 Watt Tungsten Lamp.

possible customers who adhere to gas mantle lighting. Heretofore electric lighting has been handicapped in its competition with gas on account of the cheapness of the latter but the tungsten lamp can now compete on equal terms, and it will therefore prove of great value in increasing the service of the central station.

The efficiency of a lamp depends upon the temperature at which the filament is operated and the unusually high efficiency of the tungsten lamp which, as previously stated, is about 1¼ watt per mean horizontal candle-power, is made possible by the extremely high melting point of tungsten. This permits these filaments to be operated at a temperature which would vaporize any other material of which filaments are made. Unlike all other lamps, the initial efficiency of the tungsten lamps does not decrease appreciably with the life of the lamp. Numerous tests have shown that the diminution of candle-power during the life of the lamp is very slight and Westinghouse tungsten lamps maintain practically their initial brilliancy up to the time that they burn out.

The nominal average life of tungsten lamps when used on either direct or alternating current is 800 hours, although this life is often greatly exceeded. It will be noted that this life is about double that of the high efficiency carbon lamp.

The tungsten lamp maintains practically its initial candle-power and efficiency during its whole life, the drop in candle-power being inappreciable up to the time the lamp burns out. The resistance of the tungsten filament increases with increase of temperature, therefore these lamps are not very sensitive to variations in voltage. The current does not change in direct proportion to the voltage and this makes the fluctuations in candle-power with variations of voltage relatively small. This property is manifestly advantageous on circuits having poor regulation, as a moderate change in voltage will not noticeably affect the lamps. For example a drop in voltage of 5 per cent. will reduce the candle-power of a tungsten lamp about 15 per cent.

Tungsten lamps are rated according to the total number of watts consumed, instead of the candle-power. The lamps are tested for voltage at a uniform efficiency of 1¼ watts per candle-power. This method of rating insures the lamps burning with a uniformly brilliant appearance. The slight variation of candle-power and total wattage which may occur in the lamps is unnoticeable and is of no importance in comparison to the advantage of having all the lamps burn at a uniform temperature.

#### Illumination.

The quality of the light from tungsten lamps is a pure white which resembles clear daylight. Under this light, colors appear in their true value, and slight distinctions of shades and colors are as readily appreciated under the light of a tungsten lamp as they are by daylight. This makes the tungsten lamp of great value in places where it is necessary to match colors accurately, as, for example, in dry goods stores.

---

Mr. George W. Wright, of Toronto, has been appointed assistant city engineer of London, Ont.

Mr. Charles Brandeis, consulting engineer, Montreal, Que., has removed from 63 Guardian Building to 4 Phillips place.

# Some Recent Engineering Developments in England*

## Device to Overcome Vibration in Pressure in Steel Shaft of Turbo-Generator—Devices Used in Marine Work, such as Stoking Indicators, etc.—Tatarinoff Press.

J. F. B. VANDELEUR, M.E.

In presenting this paper I beg to place before you a few notes which I made respecting the latest development in engineering practice that came to my notice during a recent trip to Europe. It is not, of course, to be expected that this covers the wide field broken into by the best of European savants in their research work but rather is a practical and general exposition of more recent development as affecting the civil, mechanical and electrical engineering profession.

### Pneumatic Brush Gear.

You will have noticed that the question of a steel shaft of a turbo-generator rotating at a very high speed has a tendency to develop two centres. The first centre is the normal mechanical centre which could be the one and only centre if it were possible that the steel shaft could have the same homogenity. This result, of course, is scientifically impossible to obtain. Therefore, around the centre we have two unequal bodies and the greater speed that these bodies obtain the greater variation, therefore, we have another centre revolving around the ordinary mechanical centre. Consequently the strain on any bearings on which this shaft travels is increased practically developing an eccentric motion.

To overcome this difficulty pneumatic brush gear for direct current generators has been introduced on account of air being extremely resilient and able to take up the slightest vibration in pressure, which would otherwise cause disintegration of the carbon blocks. The air compression is maintained by means of a small foot pump, the pressure being about three to four pounds per square inch.

Fig. 2 is a sectional view of one of the air cylinders. In this cylinder C, a small piston D is free to slide when under air pressure from the rubber bag H. The air is delivered through the stem of the cylinder from the squared brass bar into which it is screwed. At the end of the piston rod is a small conical porcelain tip J which bears on the centre of the brush block, this being slightly recessed for the purpose.

### Combined Feeder Log.

Another modern invention which I had my attention drawn to what is termed an inkless combined feeder log which has been adopted by electrical departments of Glasgow and several other corporations. One can obtain simultaneous reading of watts and frequency, volts and amperes, power factor and frequency, etc. Absolute synchronism and accuracy of time contacts is thereby obtained.

An inkless recording meter, as the name designates, is a meter which records without the use of ink or pen, the chart being formed by a series of contacts made over a type-writer ribbon, the contact impulse being actuated from a control clock which can give an impression every second, and as close as one seven hundred and sixtieth part of an inch apart, thus forming a continuous line. The most modern switch boards are now designed with these recorders and it is a matter of interest to note that frequently as many as six or seven instruments are governed by one master control clock.

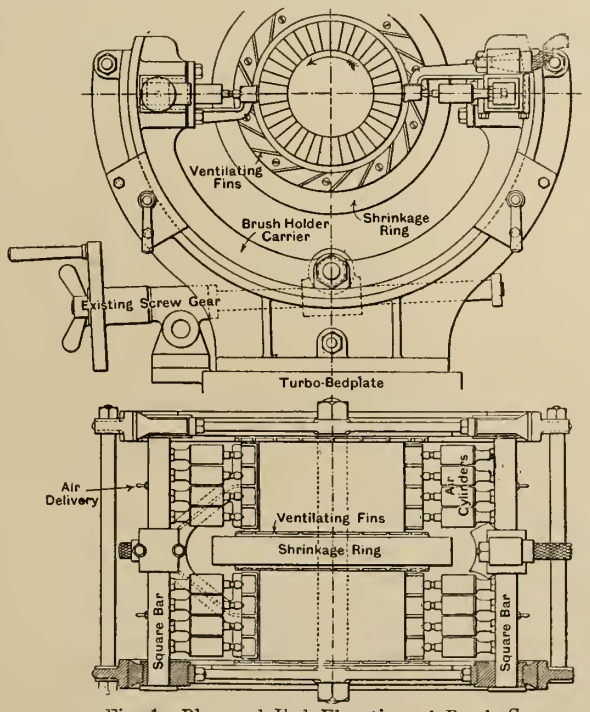



Fig. 1.—Plan and End Elevation of Brush Gear.

### Fool-proof Apparatus.

The stringent rules which have been enforced by the British Board of Trade has resulted in the demand for "Fool-proof" apparatus being met by rather elaborate product now placed on the market by several prominent manufacturers. This is exemplified by the life and fire saving devices which are now used for enclosing the live contact parts of switches, fuses and terminals. A modern switch for low-tension work in its outward appearance would merely indicate a metal box with a plunger knob attached in the centre of the face thereof. However, it will be noticed that it is impossible to open the box to make an inspection of the switch and fuses unless the plunger has been withdrawn, thereby interrupting the circuit and it is also impossible to close switch box lid when the plunger is on the "in" position, thus making sure that short circuits are impossible from the carelessness of the operator. Every switch used in the Franco-British Exposition in London last year was of this character.

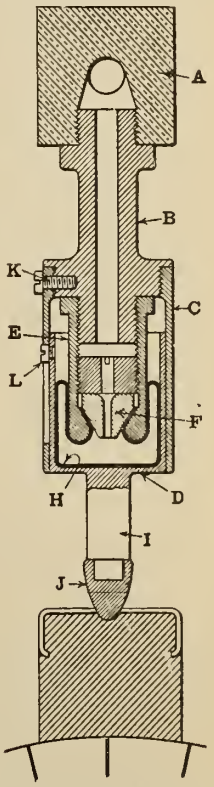



Fig. 2.—Sectional View of Air Cylinder and Brush Block.

I will now close this subject and give a brief resume of naval engineering

* From a paper read before the Engineers' Club, Toronto.

as applied to the latest developments in war ships.

### Stoking Indicator.

Regular stoking is essential to regular steaming, and is of special importance with Belleville and other water tube boilers. One must remember the fact that there are in the neighborhood of 50 boilers on board a first-class battle ship, the stoking of which are all individually indicated in the Chief Engineer's cabin. In each stoke hole an instrument of this type is erected, and is so operated that when the steam pressure of any one boiler decreases to a certain point the shutter on the instrument indicates the number of that boiler and at the same time a loud gong is struck sharply thus indicating to the stokers that attention is required at that point.

You will notice a sketch on the board which shows two guns which are situated close to each other with a limited field of fire. This sketch shows a small trumpet with a buzzer of an intolerable tone in loudness. The angle of a blast from the muzzle of a gun is about 140 degrees, thus one gun will bear on another without necessarily touching it or even being in line with the end of the other gun, and could blow the muzzle off simply by the blast. These are worked by the contacts situated from the turret trunks.

### Operation of Submarines.

Certain difficulties are inherent in the operation of submarines. The driving mechanism entails the use of a petrol engine, dynamo, motor and storage batteries, and quite a complicated switchboard. It is obvious that the most economical method in which a submarine can be driven through the water when running in a half submerged state is to drive the propellor shaft by an oil combustion engine. This engine at the same time has capacity to operate a dynamo which in turn charges the storage batteries. In order to obtain the maximum output of the generator with the minimum amount of material it has been found advisable to construct the machine of steel of high magnetic permeability, thus a greater capacity is obtained from the same dimensions of a generator that is ordinarily used for land service. When the Commanding Officer of the submarine desires to direct his boat below the surface the petrol engine is thrown out by a clutch and a change over switch throws the motor which is directly attached to the propellor shaft into operation. This motor, of course, is operated from the storage batteries before mentioned. The complete elimination of sparking is absolutely necessary, since the electrical apparatus is most rigidly tested before acceptance by the authorities.

### Arc Lamp Development.

Reverting to the electrical illuminating advancement. The latest development in arc lamps is the use of a single enclosing opalescent globe having a diameter not greater than 7 inches, which is a maximum amount of air in which an arc can be struck satisfactorily. Most of the towns in England are being lighted by flame arcs, which appears to be the only satisfactory method of lighting streets. Frequencies of 25-cycles are used now to operate flame arc lamps, the lamps being suspended in the neighborhood of 25 feet from the ground. A slight amount of flickering is noticeable. A lamp has not yet been designed which will operate on a circuit of this frequency for enclosed spaces, such as public halls, stores, etc., but in as much as the illuminating engineers of the various arc lamp companies are concentrating their attention to this feature, doubtless we may look forward to a solution of the problem at a very early date.

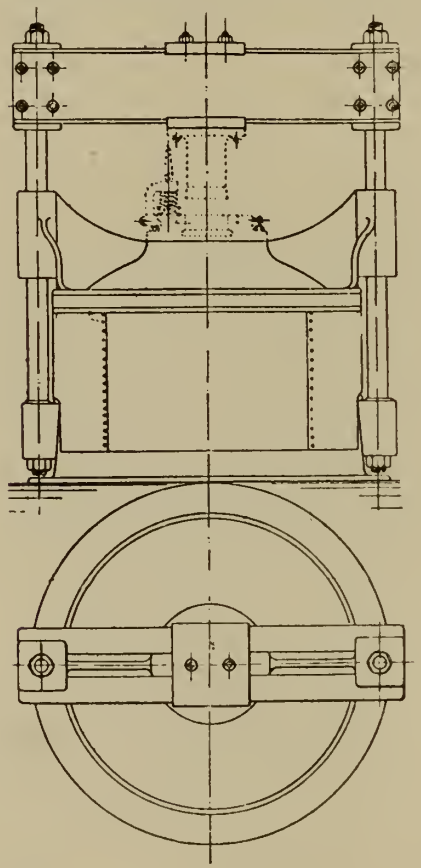


Fig. 3.—Tatarinoff's Pistonless Press.

### Tatarinoff Pistonless Press.

This press introduces mechanical principles hitherto but little understood, and even now are scarcely credited. It requires no foundation and is easily portable, for instance, a press weighing about 430 pounds is able to exert a pressure from about 24 to 30 tons. The illustration, Fig. 3, shows the principle involved. The aim of the engineers to increase the power of a press by increasing the area of the piston upon which the working fluid acts has been foiled by the technical difficulties of constructing a cylinder of large diameter in which it was possible to keep a tight gland.

The press invented by Tatarinoff has no piston whatsoever, and so the problem of increasing the power of a press by increasing the area upon which the working fluid acts is easily solved. Tatarinoff's press speaking in general terms, consists of the following parts,—(a) a receiver, the sides of which fold like the bellows of a concertina; (b) a moving plate, either top or bottom one, which bears round one of the pressing plates of the press, the second one being fastened to the stationary bottom plate of the receiver by steel columns which guide the moving top plate of the receiver. Water or air enters the receiver, and by its pressure raises the top plate, with the result that an object may be pressed between the plate of the receiver and the upper pressure plate of the press.

Having a large area the pistonless press transforms a small initial pressure into a great working pressure for all purposes for which presses are used.

The presses manufactured by the company in their latest forms have receivers, the folding sides of which consist of a rubbered canvas, as stated before, folding like the bellows of a concertina, and which can stand a pressure up to ten atmospheres to the square centimeter. The bottom plate of the receiver is connected with the pressing plate by means of steel columns. The top plate of the receiver has guiding rings. Thus the receiver is perfectly watertight and airtight. The water or air is let through an ordinary tap or valve and let out likewise. There are no packing boxes in the press, and consequently there is no danger of leaking.

Being of very simple construction and devoid of any complex parts Tatarinoff's press requires no skilled mechanic to work it or to look after it. This quality is of great importance in rural industries, and in a number of small industries, which cannot afford to employ a skilled engineer, also in those places which are situated at a great distance from any industrial centre where a skilled engineer could be obtained.

Requiring very small initial pressure, Tatarinoff's press can be worked by the pressure from an ordinary domestic water service. At outlying works and factories where there is no water installation, ordinary gravity hydraulic pressure which can be used in cases of fire,

and is stored for that purpose, is quite sufficient to work the press. Ordinary iron pipings are sufficient to connect it with the water tap, but where iron piping cannot be obtained, rubber tubing enables one to place the press wherever desired which cannot be said of those presses that are driven by shafts.

### Operation of Winches.

With regard to the operation of winches on board ships, dock yards, ship yards, hoists and mines, the day of the donkey engine is passed. The greatly increased use of electric motors has replaced the old steam driven winch which under the most favorable conditions was a source of annoyance to the operator, and in cold weather when the long lines of steam pipe were filled with the water of condensed steam it can readily be imagined that the difficulties of operation were sometimes almost insurmountable. The use of the electric motor, however, was not complete without a specially designed brake which would allow for a rapid starting, stopping and reversing. Various types have been produced, but it remained for a member of the British Institute of Engineers, by the name of Scott, to produce a brake which in its simplicity and absolute reliability is probably many years in advance in the design of other brakes. The magnetism developed in the motor itself is utilized for actuating the brake gear without interfering in any way with the mechanical simplicity and strength of the motor itself. A gap or a partial gap in the magnetic circuit at the root of the two pole pieces is made so that lines of force pass across the gap and through the brake flappers which are thus attracted.

The brake is made of cast or wrought steel and the brakes used are easily adjustable for wear. These shoes are controlled by two springs which are in parallel. Apparently the springs are designed with a large factor of safety, and appear to work well within their elastic limits, as they are large for the work they have to do. However, it will be seen that a dashpot is entirely unnecessary, and wound coils are not used in any way as they are also unnecessary.

The use of this brake affects the magnetic reluctance of the magnetic circuit to a very small degree, and I have seen a motor thus affected operate at the same speed and give the same rated output at the same temperature with the brake as without.

The starting current is not increased because the brake flappers are attracted with much less than the full load current, and the slight extra reluctance of the circuit when the brakes are partly "on" at a light load only involves a little greater speed which is rather an advantage than otherwise. These brakes are designed to operate on series direct current motors just as well as shunt wound machines.

The boat on which I crossed, that is, the R. M. S. "Lusitiana," was equipped with motors fitted with this style of brake on the davits of the life boats, and it was surprising to witness the degree of dexterity with which the operators could raise or lower a boat. It seemed as though they could adjust the motor to operate at any speed they desired.

---

# Boiler Explosion near Toronto did $60,000 Damage

## A 115 h.p. Lap-welded Boiler Explodes and Destroys Greenhouses; Parts Scattered over 1,000 ft. Radius; Probable Causes of Disaster.

The force of steam was demonstrated by an explosion that occurred at the greenhouses of F. H. and E. T. Miller,

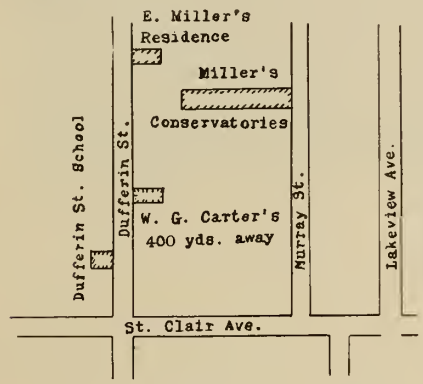



Fig. 1.—Area Affected by Explosion.

Bracondale, near Toronto on April 21. A well-built boiler, 66" x 16' long, ⅜" steel plate, with double riveted, lap-joint, horizontal seams and eighty-four 3½" boiler tubes used with three others to supply heat and water to nineteen greenhouses, exploded doing $60,000 damage to property. Fortunately, though there were twenty-three employes, none were injured. The boiler was fired from 11 o'clock and no results were observed at the greenhouse and a complaint was made to the engineer that there was no heat in the pipes. At 1.30 steam began to blow out at the joints, the boiler started to rock and as the engineer was leaving the building it exploded.

The accompanying illustrations give an idea of the destruction of the power plant. The solid brick boiler house was levelled to the ground and an 80 feet chimney was scattered over a large area. The rear course of the boiler shown in Fig. 2 lit 1,000 feet away. Figs. 1 and 2 give an idea of the area covered, windows being broken in buildings a quarter of a mile away. The piece shown in Fig. 2 weighed more than a ton.

The centre course is seen back of the rear course in the direction of the green house and about 500 ft. away. Fig. 3 shows a closer view. The stays were broken and the parts twisted out of all recognition.

Fig. 5 shows the boiler house after work of clearing the debris had begun. The exploded boiler was situated where the man in the foreground is standing. A small boiler weighing about 1½ tons, which was to his right was blown out into the fields, 400 feet away.

The front course of the boiler was deposited in a greenhouse back of the man in the background of Fig. 5. Fig. 4 is a view of the twisted front course.

Fig. 2.—General View Showing Territory Covered by Parts of Exploded Boiler.

Flattened boiler tubes were scattered over a territory of about a quarter mile radius.

### Probable Cause.

The steam gauge registered only five pounds and the water glass showed the boiler to be half full. The violence of

the explosion which wrecked the setting and power plant and projected the rear course of the boiler shell 1,000 feet and the centre course 500 feet, was such that there must have been a considerable body of heated water present when the rupture occurred.

The steam gauge when found only registered 4 or 5 lbs., but on examination the boiler been properly inspected, it would have been discovered whether or not the safety valve was in proper shape. Evidently it had rusted solid for the pressure carried was from 5 to 10 lbs., not sufficient to make the valve blow-off and keep it in working order. When found, the valve took four sharp blows of a 2½ lb. hammer to open it.

Fig. 3.—Twisted Centre Course of Boiler.

of interior, the first joint was ruptured and the end of the spring receptacle was distorted from its original curve, nearly into a straight line. This would indicate an enormous pressure; probably 400 to 500 lbs. had been exerted to do this, which would lead to supposition that boiler was tight closed. The valve has not as yet been found, but when it is, it will no doubt show that it was shut.

## EXPLOSION IN MONTREAL.

The explosion of a furnace which took place in the basement of the Congregation de Notre Dame Convent, Cote St. Paul, Montreal, was fatal in its results.

The force of the explosion was terrific and followed the initiation of the new furnace man into the mysteries of the boiler.

and was hurled through the floor above.

He was standing at the back of the furnace at the time and his scalds are slight, but the sister and Miss Florence Nault were in front on a small gallery, from which stairs led on to the floor of the basement. The sister of the furnace man was giving him instructions as to how to manipulate the heater when, with a deafening roar, the top blew off, showering metal fragments and scalding steam directly in their path, killing Miss Nault.

## C. A. S. E. NOTES.

Annual convention, London, July 27, 28 and 29.

A new lodge, No. 35, is being started in North Bay, W. J. Wilkinson having organized the lodge. One of the executive officers will initiate the new members at an early date and take part in the formal opening of the new lodge.

W. C. McGhie, executive vice-president of the C. A. S. E., attended the formal opening of the Belleville lodge on Friday, May 7th, and installed the new officers.

London Lodge held an enjoyable at home on Friday, May 7. A good programme was rendered. In addition to local talent, Charles Kelly, executive president; W. A. Crockett. executive secretary; Fowler and Norris took part. President Moll, of the London Lodge, presided at the at home.

C. A. Birge of the Canada Screw Co., Hamilton has made a large donation towards the library building fund of Victoria University, Toronto.

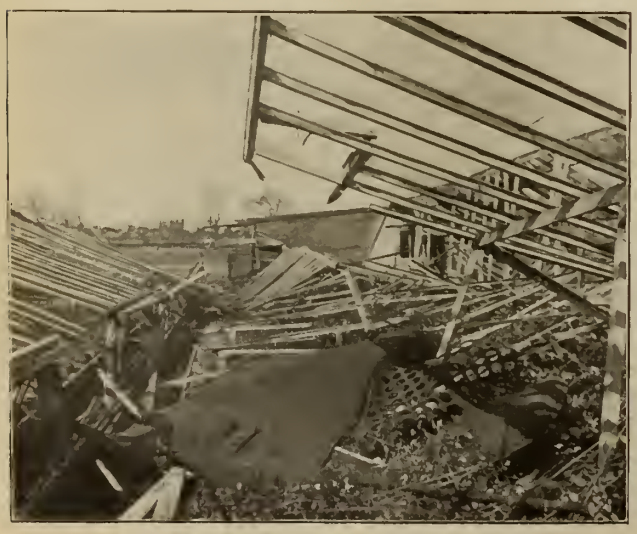


Fig. 4.—One Course Lit in the Greenhouse.

Fig. 5.—Shows Position of Boilers.

The boiler rupture evidently started in the plate itself showing that the metal above the water line was hot enough to be softened and weakened thus yielding first instead of at the seams.

The type of valve is shown in Fig. 5. It is a ball and lever arrangement. Had

It is difficult to determine the exact cause, but it is known that the man turned off the water supply valve, and it is presumed that the furnace had got very hot, and the turning in of cold water may have been the cause. The upper cap of the furnace was smashed

J. F. Lewis, Philadelphia, patentee of the Philadelphia grease cup, was a recent visitor at the Toronto office and Peterboro works of the Peterboro Lubricator Mfg. Co., who are manufacturing the Philadelphia grease cup in Canada.

# Steam Heating a City from a Central Heating Station

## A Central Heating System is in Operation at Berlin, Ontario—Description of the Central Plant and Fittings Used in the Piping Construction.

Steam heating on a large scale is comparatively new in Canada, consequently a description of a successful central plant supplying heat to a large area, with some facts relating to the operation of the system, will be of interest.

The system is controlled by the Berlin Central Heating Co., Berlin. The plant is situated on the corner of Charles and Gaukel Streets, as shown by the plan, Fig. 1. This also shows the district supplied, including Main, King, Queen and Ahrens Streets. Besides used for heating the residences on the residential streets, Queen and Ahrens, it is used for heating bath water. The steam is also used by the Shirt & Collar Co., for boiling starch, and in the Berlin Robe & Clothing Co. for boiling dye water.

Fig. 1.—Plan of Steam Mains of Berlin Central Heating Plant.

Fig. 1 shows the arrangement of pipe fittings and the explanation is given in Fig. 2. The steam pipe casing is shown in Fig. 3. This, as well as all the fittings, were supplied by the American District Steam Co., Lockport, N.Y. The outside diameter is 4 inches and inside




Fig. 2.—Explanation.

2½ inches, made of tongue and groove white pine, spirally wound with bonding wire and lined with bright tin.

A double expansion variator is placed every 100 feet. Single variators are used near a street corner. Fig. 4 shows a double variator, and Fig. 5 is a single variator. Fig. 6 shows a line drawing of the double variator. These take care of expansion and contraction.

The double variator has two copper diaphragms and is otherwise constructed with two movable ends, so that expansion and contraction are provided for two sections of pipe, fifty feet of pipe being allowed on either side. These are installed in straight lines between anchor specials.

The single variator is used where slight angles or deviations from a straight line are desired and has but one copper diaphragm and one movable end. The pipe attached to the movable end is straight from the point of beginning of expansion, on the anchor special, located fifty feet away.

The anchor specials, Fig. 7, are special fittings which establish the fixed points in the mains from which expansion takes place towards the variator and can be deviated from a straight line by angular wedges between flanges. All connections are taken off the top of variators or anchor specials.

Fig. 8 is a reducing cross, and Fig. 9 is an anchorage cross. Flanged crosses are used at street corner intersections. These crosses are provided with a means of anchorage, and are, when reducing size of mains, Fig. 8, made with eccentric openings and branches are made with sweep angles. To these crosses are bolted packingless gate valves.

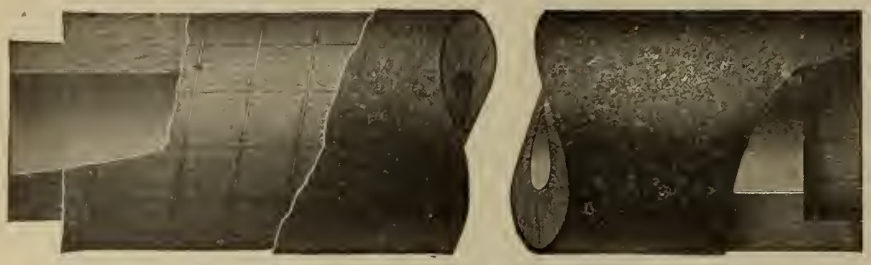


Fig. 3.—Steam Pipe Casing.

Fig. 4.—Double Variator.

### House Connections.

Where service from a central plant is to be supplied to buildings already equipped with steam radiation, only a few minor changes are required, made necessary by a different source of supply.

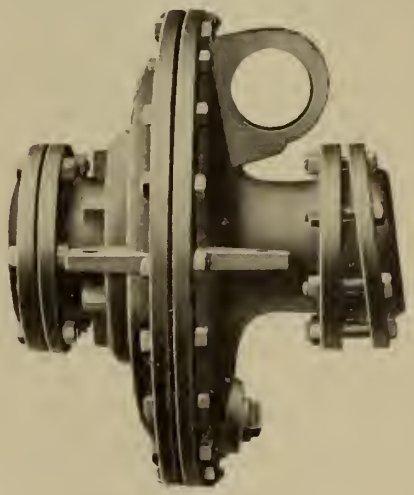


Fig. 5.—Single Variator.

In buildings not piped for steam or hot water the initial cost of necessary equipment is not as great as for a similar service from an isolated plant, due to the fact that a boiler is not required.

In the event that the customer desires to continue heating water, it is done by supplying steam from the street mains to a special form of water heater which the American District Steam Co. manufacture. The water flows through this and the steam thus condensed can be utilized and measured by meter, as in a building heated by steam. In other words, the steam is the fuel to heat the water.

In giving up its heat to the surrounding water through the tubes in the heater the steam is condensed and this condensation discharged from the trap has a temperature very near the boiling point.

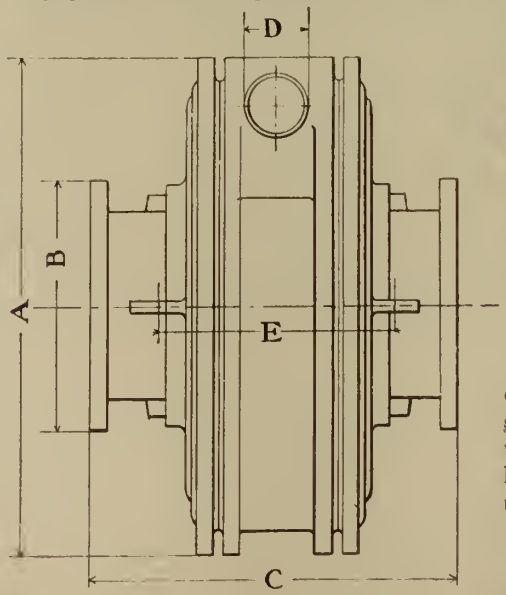



Fig. 6.—Double Variator.

Fig. 7.—Anchor Special.

The quantity of steam required to heat in this manner is no greater than the quantity required to heat directly by steam. The condensation from the radiator in the heater, after passing through the trap, is allowed to flow through a continuous cast iron economizing coil placed in each building. The coil is placed in a tin-lined box having an inlet for fresh air and an outlet through a register placed in the floor above for heated air, so that in passing through the economizing coil the condensation transmits its heat to the air, which circulates through and around the coil. This gives a supply of warm, pure air, as well as assisting ventilation. The water leaving the coils may afterwards be used for laundry and domestic purposes.

Fig. 8.—Reducing Cross.

### The Central Station.

In the power plant are two McEwen engines, one 500 and the other 320 h.p.

These are direct connected to Thompson-Ryan generators. The power is sold to the city light commission and is used for the street lighting in Berlin.

Two Canada Foundry Atlas water tube boilers of 150 h.p. each are installed. The plant was installed in 1907,

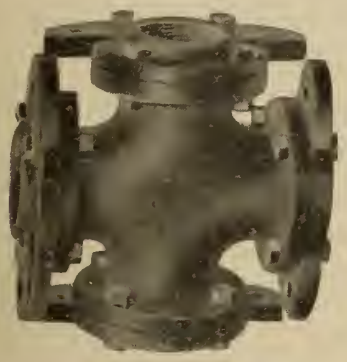


Fig. 9.—Anchorage Cross.

but many extensions have been made to the heating system since then. In case of there not being sufficient steam to supply the heating mains, a pressure reducing valve has ben placed on the boiler so that live steam may be let into the mains.

The steam operated trap and safety feed water regulator were supplied by Williams Gauge Co., Pittsburg, Pa. When the water rises in the trap, the float is raised and admits steam into the regulating valve on feed water line of boiler. The moment that this valve closes, the pressure has a tendency to rise in the feed water line and closes the regulator on the pump.

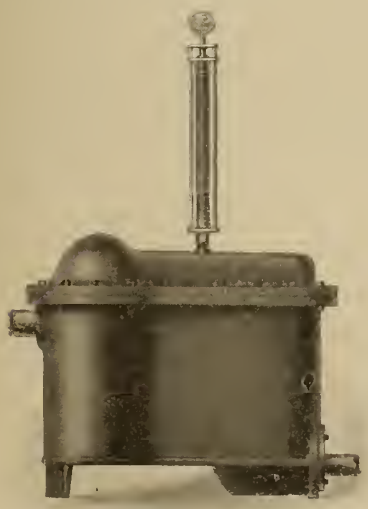


Fig. 10.—Empire Steam Trap.

In the boiler room is a 1,000 h.p. Dakin heater, built by E. Leonard & Son, London. There is also an 800 h.p. Hoppe heater. The water goes through the Hoppe first and then into the Dakin at 212 degrees, then through the economizer, raising the temperature of the water to 375 degrees. The pressure of the live steam at the boilers is 160 lbs. The pressure in the heating system is 5 lbs.

The switchboard contains the necessary instruments. It is a two-panel Vermont marble, with Westinghouse switches, two graphic recorders, ammeters, two General Electric watt meters and Westinghouse circuit breakers.

An indicator board contains Bristol recorders, giving outside temperature, pressure gauges for low and high pressure steam and temperature of stock gases after passing through the economizer. The economizer is a Sturtevant of 1,000 h.p. capacity.

The chief engineer and superintendent of the Central Heating Plant is E. Fitzgerald.

## TORONTO POWER RATES.

Following is the schedule of prices to be charged by the Toronto municipal power plant to consumers of over 300 horse power:—

Primary current, alternating 3 phase, 25 cycle, 12,000 to 13,000 volts. 24-hour service.

| Maximum Demand in h. p. | Minimum Monthly Bill. | Flat rate per h. p. per month. | —Meter rate per h. p. Hour— Off Peak | On Peak. |
|---|---|---|---|---|
| 300 .. | $344 00 | $2 29 | $0 71 | $0 06 |
| 400 .. | 425 00 | 2 12 | 0 65 | 0 06 |
| 500 .. | 506 00 | 2 02 | 0 62 | 0 06 |
| 600 .. | 588 00 | 1 96 | 0 60 | 0 06 |
| 800 .. | 750 00 | 1 87 | 0 58 | 0 06 |
| 1,000 .. | 912 00 | 1 82 | 0 56 | 0 06 |
| 1,200 .. | 1,075 00 | 1 79 | 0 55 | 0 06 |
| 1,500 .. | 1 320 00 | 1 76 | 0 54 | 0 06 |
| 2,000 .. | 1,725 00 | 1 72 | 0 53 | 0 06 |

Customer may choose either flat rate or meter rate. Rates quoted are net.

Horse-powers intermediate between quotations to be charged the higher of the two nearest rates and to carry a minimum monthly bill pro rata to such intermediate horse-power.

Term of agreement not less than five years, with privilege to customers of changing his monthly guarantee within the limits of this schedule once during first 12 months, and thereafter at 12-month intervals.

Service is to be taken subject to the general rules of the department.

Peak hours are as follows:

October 15 to October 31, 5.30 p.m. to 6.30 p.m.

November 1 to November 30, 5 p.m. to 6.30 p.m.

December 1 to January 15, 4.30 p.m. to 6.30 p.m.

January 16 to February 15, 5 p.m. to 6.30 p.m.

February 16 to March 1, 5.30 p.m. to 6.30 p.m.

While under certain circumstances the above rates are cheaper than those now being paid by Toronto consumers of power, it will be seen that 6 cents a kilowatt hour during peak load practically prohibits the use of power during the peak load hours. This, however, is meant to apply to users of power who have auxiliary plants and who could use them to carry them over lighting load during the peak loads. A new power schedule will be issued to apply to big consumers who have not auxiliary plants. That manufacturers who have capital tied up in an auxiliary plant should thus be treated doesn't seem fair business methods. It would be better to encourage in some way the use of an auxiliary plant without holding a consumer up because he has capital invested in a steam power plant.

Another point is the twenty-minute limit. If a consumer uses a high load for twenty minutes any time during a month, he must pay for the full amount during the month. For instance, a consumer may be using 300 h.p. regularly, but if one day for twenty minutes when the lights are on and all machines are at work, the power goes up to 375 h.p. and the indicator shows 375 h.p. for twenty minutes, the consumer must pay for 375 h.p. for the whole month. A consumer thus pays for something he doesn't get.

The published rates are the result of a communication from Massey-Harris, who stated that an offer had been received from the Toronto Electric Light Co. at a very low rate. This rate is .65 per k.w.h. for a consumption of power between 500 and 1,000 h.p. For 1,000 h.p. the city charge is 56, but the 20-minute peak load must be considered. As Massey-Harris have an auxiliary plant, they will come under the 6c rate during peak hours and the 56 rate will be increased.

The Massey-Harris have made no decision in regard to the purchase of power as yet, awaiting another proposition from the city.

## PERSONAL MENTION.

N. H. Brydson, of Pembroke, Ont., has been appointed city engineer of Nanaimo, B.C.

Messrs. Galt & Smith have appointed Mr. E. L. Miles, of Bala, Ont., to take charge of construction work in connection with water supply and sewage disposal at Wetaskiwin.

# Method of Setting the Valves of the Waterous Engine *

## Full Directions for Setting the Valve Gear to Obtain Proper Lead, Cut-off, Release and Compression—Changes to Make for Light and Heavy Loads.

By C. G. FISHER.

This engine has a bored steam chest and the valve rocks like a Corliss valve although its action is precisely the same as that of a slide valve. In most of these engines, the valve has a second port cast through it as shown in the section view in Fig. 1. This makes it similar to the "Trick" valve. The object of this second port is to obtain greater speed and greater area of port opening with less valve travel than can be had with the common D slide valve.

The valve is driven directly by an eccentric through the medium of the eccentric rod, rocker arm and valve stem.. The valve stem is carried in a substantial bonnet with generous bearings which insures its alignment with the valve at all times and it is so coupled with the valve that any wear which may take place in the valve or stem will not interfere with the proper seating and action of the valve. This type of valve is very satisfactory as it drives easily, and owing to its position it lubricates well, gives perfect drainage to the cylinder, and the wear is very slight.

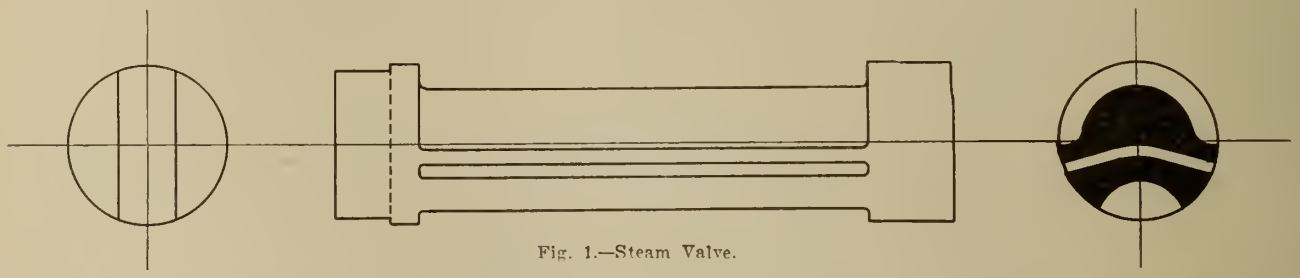


Fig. 1.—Steam Valve.

In setting the valve of this engine it should always be borne in mind that the engine was designed and built to give steam distribution, and that with a little care it may be so set again, if for any reason it becomes deranged.

The first thing to do is to adjust all the bearings of the engine the same as for running conditions. Then place the engine on the head end and crank end centres in the usual manner, and make permanent marks so that it can be placed on centre again at any time. On removing the rear steam chest bonnet, marks will be found on the chest corresponding to the port-edges, and similar marks on the valve which correspond to the steam and exhaust edges of the valve.

Next adjust the length of the eccentric rod so that the valve will rock an even distance each side of the vertical centre line by turning the engine over a complete revolution. This should be done with the pin in the rocker arm set at the centre of the slot.

The engine should now be turned in the direction it is to run until it comes to the exact head end centre, and the eccentric loosened and turned on the shaft until the valve has opened at the head end a distance equal to the lead, which may be noted by the marks at the end of the valve and chest. The lead should be about 1-16 in. When this is done the relative positions of the crank pin, eccentric and valve will be as shown in the diagram, Fig. 2.

Turn the engine to the crank end centre and note the lead. It should not be less than at the head end and had better be a little more as single valves usually have more lead at the crank end than at the head end, and it helps to equalize the cut-offs. Should it be seen that the lead at the crank end is over ⅛ in., raise the pin a little in the slot, and lengthen the eccentric rod a little.

Then place the engine on the head end centre again and test the lead. If it is not 1-16 in. the eccentric should be moved until it is, and then try the crank end lead again. Repeat this until the lead is 1-16 in. at the head end and ⅛ in. at the crank end. Had the crank end lead been less than ⅛ in. in the first trial, the pin should have been lowered and the eccentric rod shortened a little.

Repeat these trials until the lead is properly adjusted. Then the engine should be turned over and the exact distance which the piston has travelled on the forward and backward strokes at the instant of the closing of the steam ports should be measured. These distances should be nearly equal, and be about 50 per cent. of the stroke, but it will always be found greater on the forward stroke from the head end than on the stroke from the crank end.

In a 12 in. stroke engine the cut-off will take place after the piston has traveled 5½ to 6½ ins. from the head end centre, and after it has traveled 5¼ to 6 ins. from the crank end centre. If it is found that the cut-offs fall outside of these figures the setting should be gone over again. If they are too short, the eccentric must be moved away from the crank. If they are too long it must be moved nearer to the crank.

This will alter the lead, so it must be readjusted, and in this case it must be done by altering the length of the eccentric rod, which may be done by loosening the set screws in the neck of the eccentric and moving the rod in or out, or the bass box at the rocker arm end may be screwed on or off as required. It may also be necessary to raise or lower the pin in the slot.

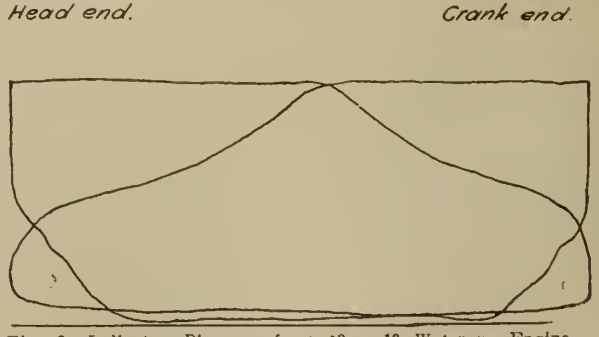



Fig. 3.—Indicator Diagram from 12 x 12 Waterous Engine.

* Second article of a series on the setting of valves on the different makes of engines on the Canadian market.

After getting the lead readjusted try the cut-offs again. It is only by carefully going over the setting in this way that the best possible valve setting can be attained.

The amount the steam port is opened by the valve should also be measured. It will be nearly equal at each end, and will appear small, but it should be remembered that the area of the "Trick" port must be added to the amount measured.

When the leads and cut offs are adjusted the release and compression should be measured, as it is well for the engineer to know all of the events in his valve motion. With a single valve, they cannot be altered without changing the other events.

In this engine the exhaust will open after the piston has travelled from 85 per cent. to 90 per cent. of its stroke, and will close at 25 per cent. before the end of the stroke at each end.

After getting the valve properly set, all of the parts should be firmly set up by the nuts and set screws provided and the engine is ready to run.

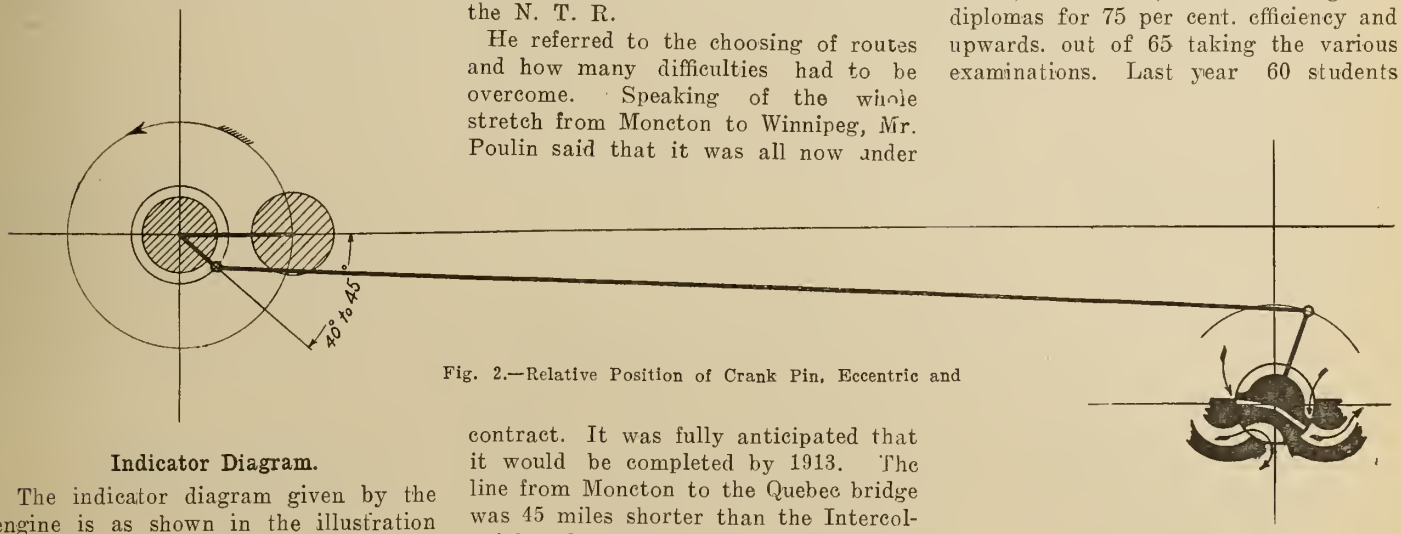



Fig. 2.—Relative Position of Crank Pin, Eccentric and

**Indicator Diagram.**

The indicator diagram given by the engine is as shown in the illustration which is a card from a 12 in. x 12 in. engine. The height of the steam line will vary with different loads as the engine is controlled by a throttling governor of the Pickering type.

If the engine is to run continuously with a light load it is best to set the valve with the pin near the top of the slot in the rocker arm, as this will reduce the valve travel and it can be set with a shorter cut-off, which will be more economical in steam consumption. This will also give the valve less lead. On the other hand if the load is generally heavy or much over load the valve had better be set with the pin near the bottom of the slot, as a longer cut-off will be the result, and a corresponding increase in the lead.

The Waterous Engine Works Company build a few small sizes of engines with the plain slide valve. These valves are set in the same manner as the rocking valve, except that the travel cannot be altered.

The company also builds the McEwen high speed automatic engine, which has a flat balanced valve, which is under the control of a shaft governor of the Rites inertia type, which gives extremely close regulation. To properly set the valve of this engine it is far better to use the indicator, for while the valve may be set the same as any slide valve, it does not show what the valve is doing with varying loads as the governor is continually shifting the eccentric. More detailed information in regard to the McEwen engine will be given in a future issue of The Power House.

## WINNIPEG CIVIL ENGINEERS.

An address on the National Transcontinental railway was delivered recently in the University building, Winnipeg, to the Winnipeg branch of the Canadian Society of Civil Engineers by S. R. Poulin, engineer of district F of the N. T. R.

He referred to the choosing of routes and how many difficulties had to be overcome. Speaking of the whole stretch from Moncton to Winnipeg, Mr. Poulin said that it was all now under contract. It was fully anticipated that it would be completed by 1913. The line from Moncton to the Quebec bridge was 45 miles shorter than the Intercolonial and it would be about 100 miles shorter to St. John, N.B. Throughout New Brunswick and Quebec it would open up a new country which hitherto had been very difficult of access. The total distance from Winnipeg to Moncton would be 1,804 miles and from Winnipeg to Quebec it would be practically 1,345 miles, which was 70 miles shorter than any present line to Montreal.

Though the question of operating the road by electricity had not yet been taken up, Mr. Poulin had not the least doubt that as soon as the road opened the question of using electrical energy as the motive power for a large portion of the line would be made a matter of deep study. One reason for that belief was the long distance that fuel for the central portion of the road would have to be hauled, and another reason was the fact that magnificent water powers were to be found all along the line. Col. Ruttan presided.

## EDUCATION OF ENGINEERS.

As a fitting conclusion to the educational classes of the Montreal Central Y.M.C.A., a students' banquet was held on Thursday evening, 15th April.

A feature of interest is to be found in the work of the engineers' group course of study, initiated and most successfully conducted by Mr. Peter Bain, of Bain & Mitchell, consulting and contracting engineers.

The course embraces mechanical drawing, machine design, drawing office practice, workshop mathematics, steam and hydraulic engineering and boiler firing.

Students may study all or any of these subjects, with the advantage that irrespective of any particular degree of knowledge, they receive individual instruction together with lecture courses to help them along.

In the examinations recently held by the International Y.M.C.A. Educational Board, New York, 55 students gained diplomas for 75 per cent. efficiency and upwards. out of 65 taking the various examinations. Last year 60 students out of a total of 73, took diplomas, one member receiving a total of 492 marks out of a possible 500, for five examinations.

Mr. Bain, the instructor, has had long and wide experience in each of the subjects, having held responsible positions both in the Old Country and Canada.

He was chief draughtsman with the John McDougall Caledonian Iron Works, leaving there to lay out the Montreal Steel Works power house.

Besides consulting work and Y.M.C.A. class work, Mr. Bain conducts courses of instruction in the foregoing subjects by correspondence, day and evening personal tuition, etc., affording all who feel themselves in any way lacking, an opportunity for direct personal knowledge. A post card addressed to him, Y.M.C.A. building, Montreal, will receive prompt attention.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

### CROSS HEAD REPAIR.

By Mac. K.

The high pressure side of a 300 h.p. cross compound tandem engine went

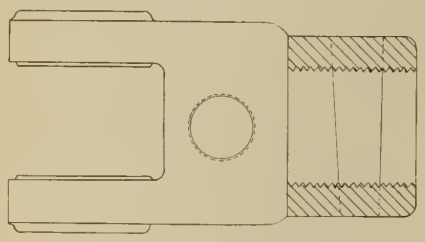


Fig. 1.—Completed Repair.

through herself one morning shortly after starting. When the wreckage was cleared away, the frame, cylinder and crosshead on that side was all that was usable. After repairs and new parts were made and when the engine was being assembled, the crosshead, a steel casting was found to be cracked through at A, Fig. 1, and partly through at B. This was at 10 a.m. on Saturday, and the engine was billed to run at 6.45, Monday a.m.

To cast and machine a new one meant a week's delay, so the old one was repaired in the following manner: The crosshead was put on a taper mandrel and turned and threaded at C, 5 in. diam. x 5½ in. long, 8 threads per inch.

A mild steel collar 7 in. diam. x 5½ in. long was bored and threaded a very tight fit for the hub C. It could not be put on more than 1½ in. using a chain wrench with a 4 ft. handle. The crosshead was then returned to the lathe and the first 2½ in. of the thread on the hub C widened on top but not cut any deeper. The taper mandrel the crosshead was machined on, was marked

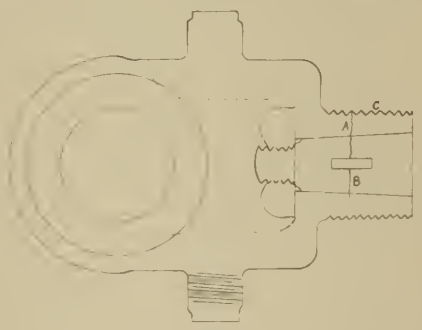



Fig. 2.—Broken Crosshead.

and taken out and the crosshead bolted securely to the platen of a large planer, with the threaded hub C up and the thread well painted with graphite.

The collar was heated to a full red and using a pair of clamps like fig. 3 was quickly screwed on. After cooling, the key slot was drilled and chipped and the collar polished. The taper mandrel could not be driven in within 5-16 in. of its former distance.

To make sure a new piston rod was gotten out that extended through the crosshead 1½ in. and threaded and

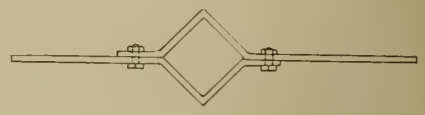


Fig. 3.—Cramp Used to Screw on Collar.

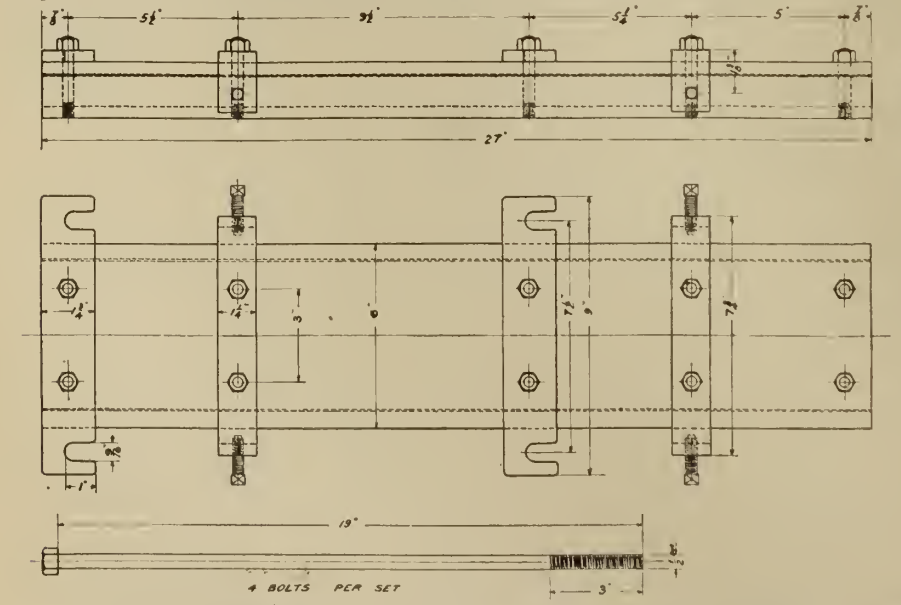
after the piston rod and crosshead were coupled up a 1½ in. nut was driven in solid. The engine ran under full load Monday a.m., and is running yet with the temporary repair in place.

---

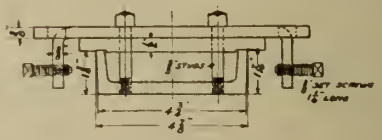
### JIG FOR RETINNING CROSSHEADS.

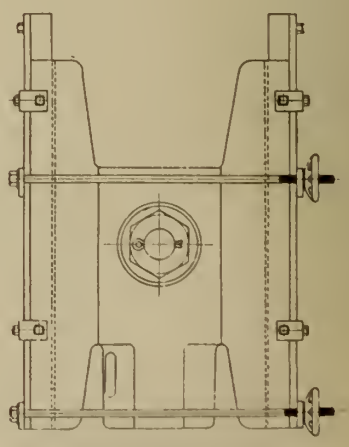
Various jigs have been used for retinning crossheads. The first were rather crude, consisting of a steel channel which fitted into the crosshead where the retinning is to be done. A small piece is turned at the top of the angle the thickness the metal is to be. The channel is kept in the centre of the part by sand. This is the crudest form and is not used in special railroad shops.

The next development is a side plate



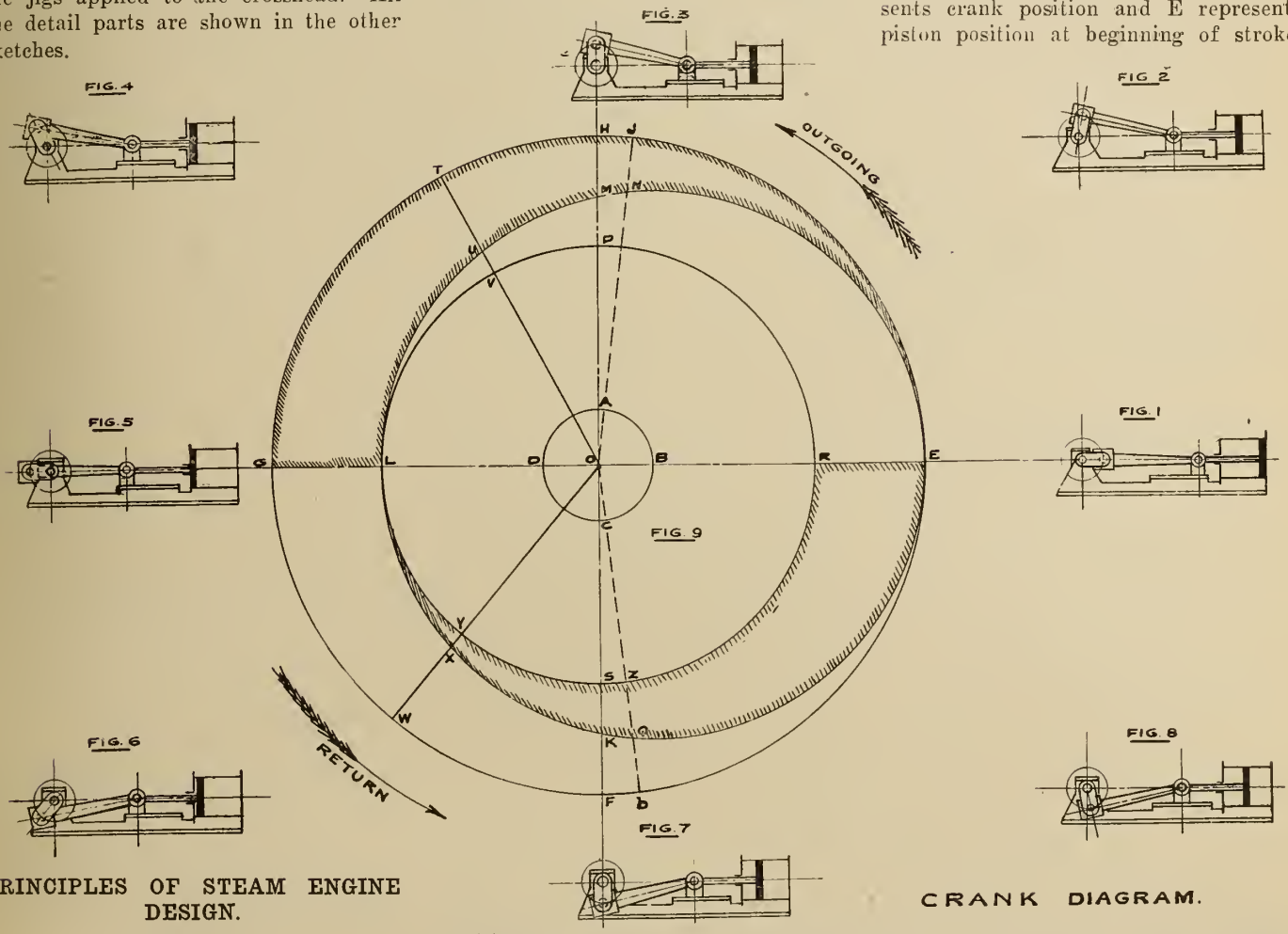

Jig Used at G.T.R., Stratford, for Retinning Crossheads.



similar to the one shown, but without the bolts. Only one jig was used at a time. This style of jig has been used in some railroad repair shops.

The jig shown in the illustration is one used in the G.T.R. Stratford shops, and is an interesting device. Two jigs are used, one on each side of the crosshead as shown. By means of these four tie bolts the jigs are used to a standard width. The four ⅜-in. x 1¼-in. long set screws shown on the side of the clamps, are used to have an even quantity of metal. The lower right-hand sketch shows the jigs applied to the crosshead. All the detail parts are shown in the other sketches.




CRANK DIAGRAM.

## PRINCIPLES OF STEAM ENGINE DESIGN.

By Peter Bain.

The purpose of this article is to show that half piston stroke in the cylinder is not half crank stroke, either in the outgoing or return movement; that for each it is variable, and that the crank diagram Fig. 9, allows of the determination of any crank position, in relation to its corresponding piston stroke. The cause of the difference is the angularity of the connecting rod in the various positions intermediate to full stroke at each end, and its effect is modified or aggravated, according as we use a longer connecting rod and a shorter crank, or vice-versa.

With the piston at either end of its stroke, the crank, piston and connecting rods are in a straight line, Figs. 1 and 5. With the piston at mid length, or half its stroke in the cylinder, Fig. 2, it would naturally be supposed that the crank would also occupy middle position; in other words be at right angles to that of Fig. 1.

The data required for the construction of the crank diagram, is the stroke of the engine, and the length of connecting rod, centre to centre. For all engines except the model or toy type, it is necessary to draw the diagram to a scale commensurate with the engine size and that of the diagram sheet. Scales of either 3 in. per foot, or 1½ in. per foot, 1 in. and ½ in. per foot will be found to satisfy most conditions. To simplify the process, an engine with cylinder 8 in. diameter, 7 in. stroke and 17½ in. centres connecting rod, is taken as example, with scale 1½ in. per foot.

### Construction.

On middle of sheet draw horizontal and vertical centre lines. At their point of intersection O describe a circle, A B C D, the diameter of which equals stroke of engine. From B mark off the length of connecting rod B E to the right. From centre O describe a circle, E F G H with radius O E; from centre B and radius B E describe a circle E K L M; and from centre O and radius O L describe a circle L P R S. The arrow indicates the direction in which the engine runs. The piston stroke measurement spaces from distances travelled, are shown shaded for both outgoing and return. Radial lines drawn from any point on circle E F G H, will indicate the position of the crank compared to that obtaining at the commencement of its stroke, and measurement along these radial lines between the circles forming the shaded portions, will give the corresponding piston travel in the cylinder.

For example, radial line E O represents crank position and E represents piston position at beginning of stroke, Fig. 1. The radial line J O represents crank position and J M piston travel from E. This amount is 3½ in. and therefore half piston stroke, Fig. 2, Radial line H O represents crank position and H M piston travel from E. This amount is 3⅞ in. and therefore rather more than half piston stroke, for mid crank stroke, Fig. 3. Radial line T O represents crank position and T U piston travel from E. This amount is 5½ in. and therefore rather more than three-quarter piston stroke for crank position easily discernible as being less than three-quarter crank stroke, Fig. 4.

Radial line G O represents crank position and L represents piston position at full outgoing stroke, 7 in., and also beginning of return stroke. Fig. 5.

Radial line W O represents crank position, and X Y piston travel from L. This amount is 1⅛ in. and therefore rather less than one quarter piston stroke for crank position easily discernible as being more than one quarter crank stroke, Fig. 6. Radial line F O represents crank position and S K piston travel from L. This amount is 3¼ in. and therefore rather less than half piston stroke, for mid crank stroke, Fig. 7. Radial line B O represents crank position and Z Q piston travel from L. This amount is 3½ in., and therefore half piston stroke, Fig. 8. The unshaded portions of the space between circles E F G H and L P R S represent the distances on each of the radial lines that the piston has still to travel in order to complete its outgoing or return stroke.

In a future article a valve diagram will be combined with that of the crank diagram, showing among other things, that this angularity of the connecting rod, affects also the cut-off, lead, lap and steam opening, in so far as equality of result for outgoing and return strokes is concerned.

---

## A POSSIBLE SAFE FLYWHEEL.

By A. L. Hodges.

There is probably no greater bone of contention and general all-round bad piece of machinery than the present-day flywheel. It used to be the boiler up to the time when that was changed in its design and make-up generally. The poor old flywheel, while of the same general design as it was ten years ago, has had an enormous amount of extra duties placed upon it. It consequently cannot stand the strain and so disintegrates occasionally, gently tapping anything or anybody in its way. Therefore, the only thing to be done is to either lessen the work of the wheel or else change its design. As the former is not liable to take place, it is up to engineers generally to change the design.

An intelligent investigation into the forces acting on the different particles of the rotating wheel will have to be made. The force tending to disintegrate is known, of course, as the centrifugal force and acts according to the formula

$$F = \frac{MV^2}{R}$$ or the force is proportional

to the mass times the square of the velocity, divided by the radius of the wheel. The only force opposed to this and holding the wheel together is that of cohesion, or the attraction between the particles of the body itself. This is enormous for some materials but only acts through very small distances, the maximum being about one four-thousandths of an inch. Consequently if the slightest crack is caused in the substance, though invisible to the naked eye, cohesion ceases.

The flywheel, improved, need not have a greater bulk, but its periphery must be strengthened. Just how to do this is the problem. One by one the liabilities to weakness must be taken up and discussed. The first is a defect in the composition of the steel. This can come about through accident in the foundry in mixing or in casting. An internal defect cannot be found in a solid piece of steel, and when a wheel explodes no one is capable of judging whether it was caused by a defect or not, as all signs of the defect would probably be the first things wiped out by the explosion. Now the tentative suggestion made here certainly does away with this difficulty.

As is well known, steel wire has an enormous strength when twisted into cables, both transverse and longitudinal. If a flywheel were constructed of layers of these cables, properly spliced and tightened, and each layer woven together, we would have a solid wheel of almost incalculable strength. A defect in the material could be easily seen and remedied, or even if not seen the effect of a single small wire breaking would be negligible. The beauty of it is the personal responsibility of each individual unit. The design of such a wheel would probably have to be worked out by experiment. One thing is sure and that is, that the cables on the rim would have to be thicker than the inside ones, on account of the force varying directly as the square of the velocity of each part, but inversely only as the radius of the wheel.

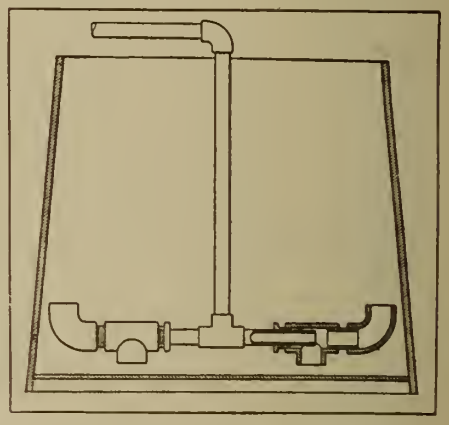
The shape then would probably be wide on the periphery and run obliquely down to near the centre on each side. Now, of course, it is desirable that the moment of inertia of such a wheel be exactly that of the wheel it displaces without taking up any more vertical room. As is seen, this can be easily done by widening the rim with more cables, and can be easily tested by experiment.

However, as was said before, this is only a suggestion to engineers in general. Something has certainly got to be done about the flywheel and the sooner the better. For the sooner a decent one is designed and put into use, just so much joy will be added to the world by allowing the poor devils a natural lease of life that are now doomed to be killed by exploding flywheels. We know that about so many will be killed the coming year, for that many were killed last year and that many the year before.

## STOPPING NOISE IN STEAM PIPES.

When steam at 70 or 80 lb. pressure is turned into a tank of cold water for heating there will be a very disagreeable noise. A certain plant using a large quantity of hot water had to heat their water with steam, and to eliminate the noise they constructed a device as shown in the sketch. As a siphon ejector will make no noise of any consequence, this principle was applied, says the Practical Engineer. The ⅜-in. main pipe carrying the steam into the tank was fitted with a tee on the bottom end, and into this tee two nipples were fitted with long threads on the outer ends. These ends were fitted with two ⅜- by 1¼-in. bushings, allowing the ends to extend through them. On these bushings were screwed two 1¼-in. tees with a short nipple and an elbow as shown in the sketch.

When the steam is passing in a jet at the end of the small pipe in the large



Noiseless Steam Water Heater.

tee, the water will be drawn up from the bottom of the tank and upward at the sides through the ell and return to the bottom of the tank again down the centre, causing a continuous circulation until the water reaches the boiling point. The noise made by the appliance when at work is no more than that made by an ordinary-sized injector or a siphon-ejector.

---

The City of Sturgeon Bay, Wis., is setting an example for its sister cities in the matter of economy. A combination municipal waterworks, electric lighting and heating plant has just been completed. Exhaust steam that operates the first-named departments is used to heat the municipal buildings and schools. The system was built at a cost of $40,000. This is the first plant of the kind in Wisconsin and the three sources of revenue are expected to pay well.

# Correspondence and Discussion on Previous Articles

Discussion is Welcome on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### BOILER HEATING SURFACE.

I would like a reader to give me a short method for finding the heating surface of a return tubular boiler not taking the heads into consideration.—Fireman.

In reply to "Fireman's" question I submit the following rule: Multiply the diameter of one tube in inches by the number of tubes, add to the product the radius of the boiler in inches, then multiply the sum by the length of the boiler in feet and again multiply the product by the factor .2618, which will give the heating surface in square feet.

As an example, take a boiler with 78 three-inch tubes, 36 in. radius and 18 ft. long. The heating surface is found as follows:

3×78=234.
234+36=270.
270×18=4860.
4860×.2618=1272.3 square feet heating surfoce.

F. STUBBS.

### REFRIGERATING MACHINES.

Chatham.—Will you please send me all information in regard to refrigerating machinery.

Answer.—A book, "Refrigeration and Ice Making and Refrigerating Machinery," by W. H. Wakeman, is for sale by the MacLean Publishing Co., 10 Front Street, Toronto. It is a practical treatise on the construction, operation, care and maintenance of refrigerating and ice-making machinery.—W. A. CROCKETT.

### HOT CRANKS.

I was very impressed with that letter from "One of the Boys" in the April issue of your journal. It was the most interesting article I have read in any power journal for some time, water in cylinders will certainly cause a lot of trouble. Steam should be allowed to pass through the engine for some time before starting.

I have had charge of a compound Wheelock for over two years and have never put a wrench on the crank and I am sure there is no slack at present. I am carrying a load of about 800 lights every night.

I think a great many engineers make the mistake of using their wrench around the cross head and crank too much. Some engineers get into the habit of making their brasses too tight. It is better to have a little play than to have hot boxes all the time; just make the boxes a snug fit and see that your oil cups don't get clogged; remove them often and take them apart and flush them out with coal oil or gasoline and strain all the oil used on the crank through a cotton rag; keep a tight cap on the oil cup and your troubles will be less. Also, take my advice and use the monkey wrench less. LIVE WIRE.

### THE QUESTION OF VACUUM.

Most all engineering authors tell us that water can be lifted 33 ft., but that the best known lift is 29 ft. 6 inches. Now science tells us that the atmosphere exerts a pressure of 14 7-10 lbs per square in. or 235.2 oz.

And we all know that a complete vacuum is said to exist when any vessel is entirely void of matter, that is to say, even the air is extracted. Now we see that if it were possible to cause a perfect vacuum we would be able to lift water or any other liquid as high in inches as the weight of 1 cubic inch would divide or go into the weight of the atmospheric pressure, which, as stated above is 235.2 oz. Therefore 1 cu. ft. of water weighs 62½ lbs. or 1,000 oz., and contains 1,728 cu. inches. 1 cu. inch weighs :

$\frac{1000}{1728}$ = .5781 or $\frac{5781}{10{,}000}$ parts of 1 oz.

Therefore atmospheric pressure or 235.2 oz. divided by .5781 equal 406.85 cu. in. or height water could be raised with a perfect vacuum, which divided by 12 equal 33 ft. 10.85 inches.

But science has proven that it is not possible to cause a perfect vacuum, but that only from 89 to 91 p.c. can be caused, therefore we take 406.85 inches and divide by 100 to get 1 p.c. which gives us 4.0685, then multiply by 89 and 91 or for an average of the two, by 90, this gives us 4.0685 X 90 equals 366.1650 inches or divided by 12 equals 30 ft. 6.1650 inches or 30 ft. 6 inches.

These results however were secured by miniature apparatus, which was no doubt as near mechanically perfect as it was possible to secure. We therefore can scarcely count on these results with the average pump or mechanical apparatus, but would be wise to count on say 80 p.c. which would give us a lift of 4.0685 X 80 equals 325.4800 inches divided by 12 equals 27 ft., 1.4800 in. or 27 ft. 1½ inches.

These calculations are for fresh water, but the same rule applies to all liquids. By simply finding the exact weight of the liquid in question, for instance an oil 50 p.c. lighter than water should be lifted 50 p.c. higher than water.

If it is true that the atmospheric pressure varies at times, this will make some slight difference.

TRADE FRIEND.

### ALUMINUM FOR TRANSMISSION LINE.

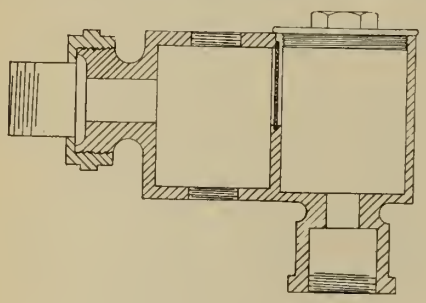
An interesting article under this title is contributed by an engineering correspondent to a recent issue of the Engineering Supplement of the London Times. In it he points out that the price of aluminum per ton being now approximately the same as that of copper, and taking into account the relative specific gravities and electric conductivities of the two metals, aluminum might now be profitably used in many cases for overhead transmission of electricity and other allied purposes. For the same money an aluminum conductor of the same electrical conductivity can be carried rather more than twice as far as one made of copper. But there are other advantages in addition which would be realized were aluminum employed; the energy loss would be less per given length of line, whilst for the same rise in temperature the aluminum will carry a greater current than the copper. A particular case is worked out showing that whilst 184 amperes will cause a rise of 20 degrees, C., in a copper conductor of 1 square centimetre, cross-section, and aluminum conductor of equal conductivity will require 268 amperes to raise its temperature by the same amount, showing an advantage of about 13 per cent. for the aluminum conductor. In the case of overhead lines a further economy would be incurred in that the specifically lighter aluminum would lessen the cost for towers, insulation and labor of erection; but on the other hand, the greater diameter of an equivalent aluminum conductor involves greater radiation, so that some of the economic advantage would be lost. With underground conductors the large diameter of the aluminum conductor would mean an increased outlay on the insulating coverings, and this would usually offset the decreased outlay on the conductor.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### VACUUM VALVE.

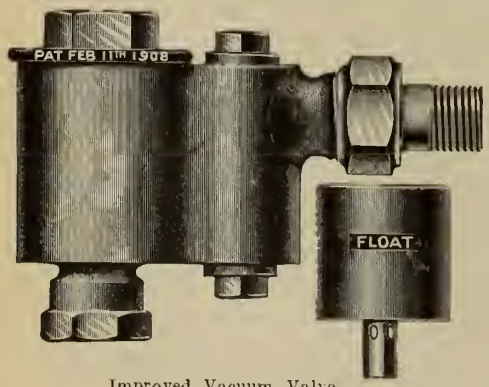
The "N.D." is a vacuum valve invented a year ago by N. Dolese. Recently several improvements have been made and the improved valve is here illustrated in Figs. 1 and 2. The valve fits on the end of the radiator. It is automatic in action and when attached to a heat unit any condensation forms



Improved Vacuum Valve

a water seal around the body of the valve and the float, thus effectively separating the heat unit from the return end to the vacuum pump and still maintain a vacuum, through the medium of the orifice in the side of the chamber containing the float, which is connected to the return pipe.

When sufficient condensation has taken place the float rises until the port holes shown in the tube connection of the float in Fig. 1, are above the seat of the body of the valve. Thus




Improved Vacuum Valve.

the valve automatically adjusts itself to the condensation it has to take care of. Hot water is pumped to the boiler at 160 to 180 degrees F.

Another chamber has been added to the original in which all dirt is collected and is blown out at either top or bottom by simply turning the nut screw. The dirt screen which is added can also be removed, cleaned and replaced.

This valve is manufactured by the Canadian Steam Boiler Equipment Co., 36-38 Lombard St., Toronto.

---

### COMBINATION BELTING.

A new patented combination belting has been placed on the market. It is composed of a number of parallel strands of specially made steel wires, each strand being covered by fine hemp marlin. These parallel strands are held together at regular intervals by cross strands of the same wire covered in the same manner. The strands are made of from seven to nineteen wires, according to the strength or horse-power desired.

It is claimd that the belt combines the strength of steel with the well-known durability and high co-efficient of friction of prepared marlin, giving it the highest possible transmission qualities.

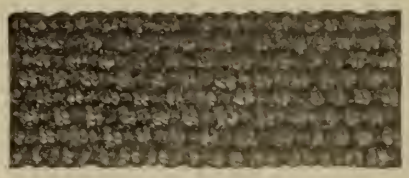


Fig. 1.—Belting Before Use.

The belt can be either clamped or spliced, and is easily applied. There is but very little stretch, a new 16-strand belt showing under test a stretch of .0014 (fourteen ten-thousandths) for every 1,000 pounds load put upon it. A rolling process, through which the belt passes after it is made, still further reduces this percentage.

Among the advantages claimed are the saving of size in pulleys, less width of belting required, with a consequent saving in space, the saving in weight, very small loss from creep, it being one and one-half per cent. (1½ per cent.), and the fact that the combination belt is not affected by heat or moisture.

The process of making the belt and

Fig. 2.—Belting After Use.

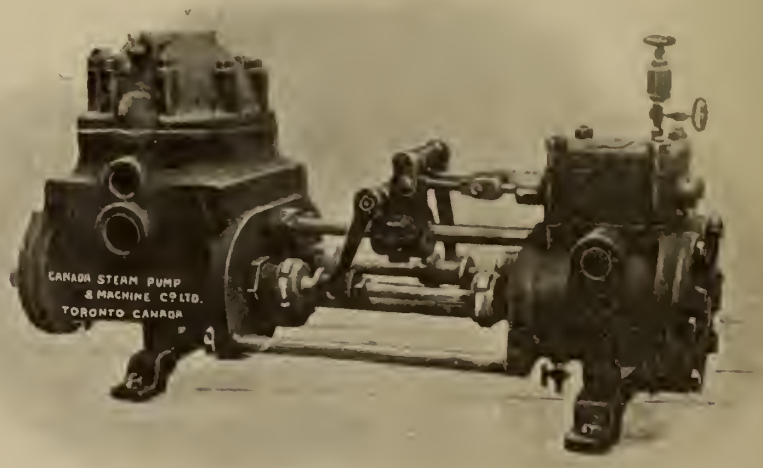
the machinery on which it is made are covered by patents in this and foreign countries. Conveyor belt is also made in any required widths, and in this form of belt the marlin is free from tar or any other preparation, so as not to affect the material conveyed.

This belting is manufactured by the Massachusetts Belting Co., 207 Congress Street, Boston, Mass.

---

### A COMBINATION PUMP.

The introduction of a new combination pump into the many systems of heating both by live and exhaust steam, has been followed by gratifying results. The economic and simple features are generally recognized. The pump is a vacuum and boiler feed combined in one,




A Combination Pump for Heating System and Boiler Supply.

and driven as an ordinary duplex steam pump, each having its own suction and discharge separate.

The purpose for which it was designed, was to be used in connection with steam heating systems especially where the ordinary gravity low pressure systems are installed, whereby a simple alteration of piping and with one of these pumps can be converted into a vacuum heating system, giving much better results, a more even heat absolutely noiseless, and a reduction in the consumption of fuel.

With double combination vacuum pumps a heating system can be compounded by dividing it into two sections, and the condensation from the first being pumped into the second is again flashed into steam, by using a higher vacuum, which again condenses and is then pumped back to the boiler, or atmosphere. A number of these pumps connected to heating systems have been installed, and are operating both live and exhaust steam, which are giving good results. They can also be used on double and triple effects described in the December issue of The Power House, in laundries, confectioneries, distilleries, breweries, etc., and also as air and circular pumps for surface condensers. The Canada Steam Pump and Machine Co., 97 Richmond Street East, Toronto, are the makers and have one of these combination pumps in operation in their works.

---

## STANDARD CROWN VALVE.

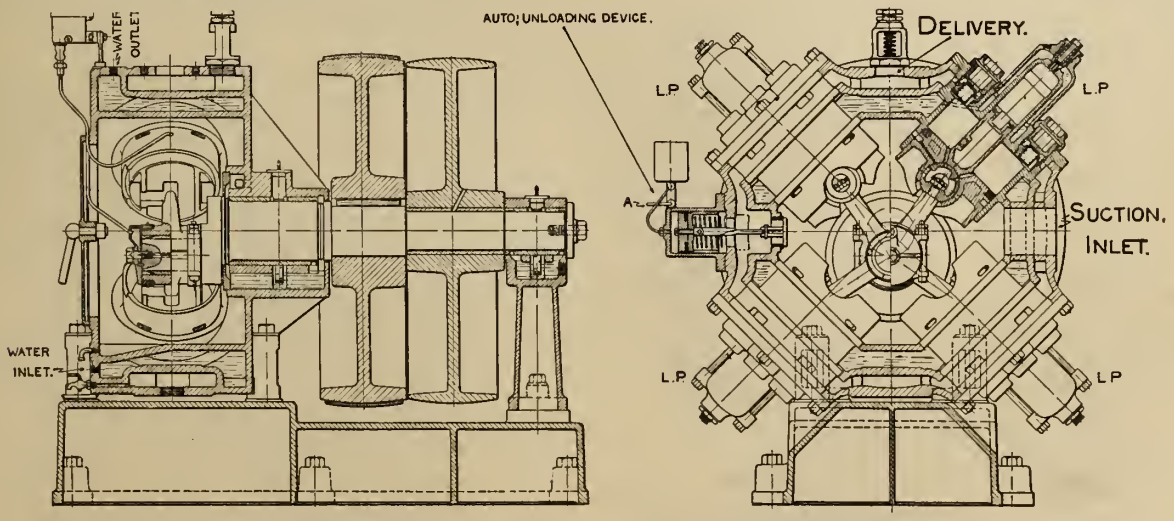
The Standard Crown Valve is designed to give a full and free passage through the valve, equal to the cross section of the pipe. The special point is in the design of the cup and seat. An examination of the accompanying illustration will show that the seat is not cast with the body, but made separate and is therefore removable at will.

It will also be noticed that the cup comes in contact with the seat at two points, making two positive stoppages of the passage through the valve when same is closed.

In the Standard Crown valve, the current rises up in the centre against the cup, and then flows down evenly all around between the cup and seat and then outward, tending to wear the parts exactly the same in all directions. On closing the valve, the cup is brought down squarely on the seat, being guided by the ribs as shown.

Standard Crown Valve.

The valve is placed on the market by the Standard Engineering Co., 43 Scott St., Toronto.




Section of Standard Belt-driven Single-Stage Air Compressor.

## REAVELL COMPRESSOR.

The "Reavell" compressor has four cylinders arranged radially in a circular shaped casing, each of the four cylinders is fitted with a trunk piston, and the four connecting rods are all driven from a common crank pin. The casing contains an annular space through which the cylinders pass. Each cylinder forms a separate single-acting compressor, and as they all deliver into a common delivery passage, a practically continuous delivery of air is secured, because the compressor, owing to the pressure being always in one direction, can be run at relatively high speeds.

The compressor has no suction valves, air being admitted above each piston by means of a port in the latter which coincides with a similar port in the top of each connecting rod during the stroke, and near the end of this stroke the piston over-runs the ports cut through the cylinder wall, thus making a direct communication between the cylinder and the inside of the compressor casing, which is arranged to form a suction chamber.

The illustration shows a belt driven machine.

Direct coupling is obtained either by extending the crankshaft of the compressor and threading it through the armature of the motor, the outer end of the crankshaft running in the motor bearing, or by fitting the compressor crankshaft to the half coupling, the motor being supplied with one bearing and armature built on shaft with half couplings. The 2 half couplings are rigidly bolted together, and the combination under either of the above arrangements runs with only two bearings.

They are to be found in use in all parts of the world in connection with mines, chemical works, breweries, workshops, water lifting, acid pumping and all the various uses to which compressed air can be put.

The compressor is made by Reavell & Co., Ranelagh Works, Ipswich, England, for whom, J. F. B. Vandeleur, Dineen Building, Toronto, is agent for Canada.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*

*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe 933-935 Monadnock Block
NEW YORK - R. B. Huestis 622-624 Tribune Bldg. Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wolf Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II MAY, 1909 No. 5

## CONTENTS

The Practical Side of Work at a Canadian University - - 13
Course of Lessons for the Instruction of Stationary Engineers - - - - - 16
The Ice Jam at Niagara Does Considerable Damage - - 17
Electricity by Wind Power - 17
Tungsten Lamps for Alternating and Direct Current - 18
Some Recent Engineering Developments in England - 19
Boiler Explosion Near Toronto did $60,000 Damage - - 21
Explosion in Montreal - - 22
C.A.S.E. Notes - - - 22
Steam Heating a City From a Central Heating Station - 23
Toronto Power Rates - - 25
Method of Setting the Valves of the Waterous Engine - - 26
Winnipeg Civil Engineers - - 27
Education of Engineers - - 27
Practical Articles by our Readers 28
Cross Head Repairs.
Jig for Retinning Cross-heads.
Principles of Steam Engine Design.
A Possible Safe Flywheel.
Stopping Noise in Steam Pipes.
Correspondence and Discussion on Previous Articles - - 31
Boiler Heating Surface.
Refrigerating Machines.
Hot Cranks.
The Question of Vacuum.
Aluminum for Transmission Line 31
New Equipment for Power Plants - - - - - 32
Vacuum Valve.
Combination Belting.
A Combination Pump.
Standard Crown Valve.
Reavell Compressor.
Editorial - - - - 34
Developments in Manufacture of Gas Producers - - 36
Recent Developments in Canadian Made Grates - - 37
A Metallic Packing - - 37
Power Plant Developments - 38
Catalogues - - - 38
Power Supply Markets - - 40
Book Reviews - - - 40

### THE NEWS VALUE OF OUR ADVERTISING PAGES.

We have made frequent reference to the great value of the advertising pages to the readers of The Power House. Some of our readers probably do not realize that valuable suggestions are frequently to be found in the advertising columns. Every issue contains something new and interesting in the advertising, as well as the other pages. Improvements in power house equipment are illustrated and devices are fully explained.

Advertisers are always not only willing, but pleased, to send enquirers printed matter in reference to their machinery and transmission and power equipment. Not only do they spend money on that, but they spend time and money to make their advertising attractive and give engineers necessary information.

That the advertising pages of this paper are kept up to a high standard is shown by this extract from a letter received from an electrician in charge of a large electric light plant:

> "I think The Power House leads them all in the news engineers require. It is attractively gotten up and no engineer should be without it.
>
> "The advertising section of the paper is nicely arranged, and such handsome cuts are reproduced that it adds a great deal of value to the paper. It certainly should be a good investment to those who purchase the space."

Our art and advertising departments co-operate with the advertisers in the preparation of copy, and advertising matter prepared by these departments is attracting widespread attention and several instances have been observed where illustrated advertisements prepared by these departments of The Power House have been used in other publications by our advertisers. This circumstance shows the efficiency of the art and ad. departments, when advertisements prepared by them so forcibly attract the eye and reason of the critic.

The advertising pages of The Power House, backed by the good taste of the advertisers, and by our own art and ad. departments are steadily growing more interesting and every reader should peruse carefully these pages every month.

### BOILER INSPECTION LEGISLATION NEEDED.

Since its inception, The Power House has pointed out in its editorial and correspondence columns the necessity of a Dominion law covering boiler inspection and the licensing of engineers. We regret to have to report in this issue two boiler explosions, one, at least, caused by the non-inspection of the boiler.

"What is everybody's business is nobody's business," is as true in regard to boiler inspection as to any other department of life, and the lack of interest taken in securing legislation is not altogether because manufacturers are not interested. Each province has its own laws, such as they are, and anyone with five years' experience can inspect boilers according to the Factories Act. One of the large Ontario boiler manufacturers stated to a representative of The Power House that there were probably only two in his whole works capable of inspecting a boiler, the foreman and the marker-off. There were men with more than five years' experience, who, according to law, could inspect the boilers, but though they were excellent mechanics and did very satisfactory work, they understood nothing about the theory of boilers, which is so important to know for the proper inspection of boilers.

The Ontario act granting certificates to engineers qualified to hold them was made with the safety of life and property in view. All boilers of over fifty horse-power and over 20 lbs. pressure, must be under the supervision of a licensed engineer. It is fortunate that no lives were lost in the unfortunate accident described in this issue, for as the boiler was for heating purposes, there was no licensed engineer in charge of the plant. The Governments have not gone far enough and strict laws compelling inspection should be made and rigidly enforced.

We are not free to kill each other and too great care cannot be taken both in the selection of an engineer and to have a very careful inspection regularly. Some companies will, no doubt, neglect to have anything done until an explosion nearer home, with all its devastating results, brings it to mind. On such companies a little pressure will make them realize that the protection of life and property is to be insisted on.

The boiler inspection companies are doing good work but the work of inspection must be broader and there should be compulsory boiler inspection covering all boilers. The different provinces have different laws and some Canadian cities have boiler laws. It will, therefore, be understood when we repeat, "What's everybody's business is nobody's business." Boiler inspection is clearly for the general welfare of Canada. As the marine boilers, so should stationary boilers, be under charge of a board or department who would be held responsible for their inspection. Every engineer should devote all his power toward awakening the interest of every person in a thing so vital to the general public themselves.

Such accidents as the one to which we have referred, can only be eliminated by proper legislation. This can be obtained by an organized movement on the part of the engineers and public generally, if not a strict Dominion law, then strict provincial laws.

## C. E. A. ANNUAL CONVENTION.

The annual convention of the Canadian Electrical Association will be held in Quebec, June 16, 17 and 18. Some interesting and instructive papers are being prepared and will be read at this convention. Arrangements are being made for a fine convention and central station men and electrical engineers should arrange to attend.

June is a fine holiday month and the electrical engineers of Quebec mean the convention to be a big success. Those who attend will return to their work benefitted by the outing and visit to the celebrated Old Capital and with many new ideas after meeting on common ground with brother engineers.

## GET READY.

This isn't a sermon ; we have no inclination to get into a pulpit and listen to ourselves talk, but we do want to be of assistance to our readers. The inspiration for this chat came from a conversation we had with one of the big practical men in what are perhaps the largest shops in Eastern Canada. We asked him if there were many instances where a boy or man had been promoted and had "fallen down" on his new position, necessitating either a return to his old job or seeking new quarters. The answer we got was that it frequently happened, and the reason was given : "He wasn't ready." A man may be an expert in one grade of his work and may impress his employer with the fact that he is equal to increased responsibilities, with the accompanying increase in pay, but, unless he is prepared, unless he is ready for the promotion he will "fall down" nine times out of ten. The tenth man is the one who is clever enough to get ready after he has his promotion, and there are very few of these.

A splendid way to get ready is to keep well posted with the developments in your trade, and to keep a tangible record of these developments because no one can keep them all in his head. A good way to do this is to subscribe to and read one or two good monthly technical papers.

The excuse is sometimes given that one has no time for the technical papers. One half hour every other day will do wonders and there are few who cannot afford this much attention to their advancement. Above all things keep notes. This is one of the most helpful of all the plans to get ready. When you see a new way of doing a thing, make a note of it ; when you read some interesting article relative to your line of work cut it out and paste it in your note book. An engineering notebook is a valuable asset and they cannot be compiled in a short time. It took years to gather together all the information in notebooks like Kent's or Trautwine's or Suplee's. Put your ideas on paper. Writing your ideas makes you fluent, enables you to make yourself clear to others, is an assistance in getting ready, and the main thing is to get ready for that promotion when it comes along.

## TOPICS OF THE MONTH.

Charles A. Parsons visited America last month arriving in New York April 11 on the Mauretania. It was quite appropriate that this vessel is equipped with his turbine. In an interview Mr. Parsons said : "There is no missing link in the turbine, the present type is the very best that can now be made. It is a very perfect engine and not liable to accident. There are probably 100 turbine steamships now and not one of them has broken down. One of the fastest vessels in your navy, the scout cruiser Chester, is equipped with our turbine and will run away from the Salem in the special speed trial."

* * *

Gone up in smoke, $50,000,000 ! Chief Inspector Bird, of Chicago, says that the yearly loss of manufactured articles in Chicago, by smoke, reaches this amount. The smoke problem in Chicago is a gigantic one and that city is a fertile field for smoke consumer devices.

* * *

Toronto celebrated its 75th birthday on March 6. The seventy-five years have shown wonderful advances in the industrial life of Canada. Railways, thousands of miles of them, have been built, new towns have sprung up on every hand, tall chimneys have arisen in countless corners of Canada, and the population is now nearly 7,000,000. Toronto has been favored during these years with railways, commerce and population, making it the second city of Canada.

# Developments in Manufacture of Gas Producers

Gas Producers are Being Improved so that Better Results are now Obtainable with Producer Gas as a Source of Power than Formerly.

By J. DYMOND *

The great development that has taken place during recent years in connection with internal combustion engines, has placed them in the foremost rank of cheap motive power, provided they are constructed upon sound thermo-dynamical and good practical mechanical design, embodying liberal proportions of material of the highest class of their respective kinds, and the best workmanship.

The gas engine, however, does not stand alone in the greatest achievements of modern science, with it must be considered its chief factor, the gas producer. It is impossible for anyone to thoroughly understand the higher principles of gas making machinery and the essential parts which are necessary to produce gas of a higher quality than is generally seen in use at the present time, without knowing what is requisite, and how to obtain the desired results.

Gas producer manufacturers who are incompetent and not thoroughly practical in all branches appertaining to the same are satisfied with seeing gas which burns with a blue flame or slightly impregnated with a little red or yellow mixed therewith from the purge pipe. It should be clearly understood that the color of this gas is very low in explosive matter, and possesses considerable impurities.

Gas of a higher quality, strong in explosive matter, practically free from impurities, absolutely reliable and positive in its action in the continuous running of any first-class gas engine, can be obtained at a low cost, with a machine that is scientifically and mechanically arranged on the most modern and up-to-date principles, thus placing the gas engine and gas producer plant on a level with any other system of motive power for reliability and practical operation. High class gas-making machinery of the present day, is not only built on modern and up-to-date scientific principles, but embodies practical experience of many years' standing, exploiting the different kinds of fuel most suitable for good gas-making purposes.

Joseph Dawson, London, England, was the first to introduce producer gas for gas engine driving in England. The writer took charge of one of his early plants, which was installed to drive a Crossley gas engine, and, subsequently, for the heating of various machines, and for other purposes, which were developed by the writer himself.

From the crude way in which this plant was installed and the various incomplete arrangements attached thereto, considerable difficulty was encountered, and it was found impossible to keep the engine running for any reasonable length of time without a stop, Several minor improvements were also made, the results being that longer runs were obtained and better gas produced.

In March, 1904, patents for improvements upon gas-making machinery were applied for in Great Britain by the inventor, and, in 1905 and 1906, other patents were also applied for. In 1907, British patents were applied for and obtained under which a new machine was built and the Dawson plant referred to, was superseded by the producer built under these patents.

The patentee found the results so satisfactory from his new machine that even his anticipations were exceeded, the gas being of a high uniform quality, and the coal consumption very low, approximately three-quarters of a pound per b.h.p. per hour. This plant is still at work.

In 1898 another British patent was applied for and obtained. The improvements embodied in this patent were of such a nature that several machines were sold and installed, and gave the utmost satisfaction in each instance, replacing producers built by different makers.

In one instance gas was carried in mains for about two miles from a central plant to supply engines that were located in various parts of the town. This plant gave very high class results.

### An Efficient Machine.

A leading English professor in gas producer work pronounced it one of the most perfect of the kind at that time. and very economical. Four of Crossley's horizontal engines were supplied from this plant, aggregating approximately 100 b.h.p.. A three months' coal consumption test was made upon this plant, the engines ran about 72 hours per week, July 1 to October 1, during which time seventeen tons of coal were consumed. These figures were obtained from the secretary of the company, who purchased the plant and are, therefore, authentic.

Considerable improvements have been made since these machines were installed, and other patents obtained. Under the more recent patents machines have been built which stand without a rival for high efficiency, great economy and positiveness in continuous operation, giving a 24 hour service for the week and requiring but little attention, the speed of the gas engines being kept practically constant during the whole run, developing its full b.h.p. load.

Suction gas-making machines are now being produced, which excel anything hitherto attempted or achieved. The new improved suction producer is constructed in such a manner that a high thermal efficiency can be obtained, the consumption of coal, at or near sea level, being only 8-10 of a lb. anthracite coal, containing 14,500 B.t.u. per pound, the speed of the engine being kept within 2 per cent. The high-class results obtained with this machine are attributed to the highly efficient superheating arrangements embodied in the construction.

It has been asserted by some writers that it is not possible to make a successful convertible suction and pressure gas producer.

Assertions of this kind are only made by inexperienced men, as a plant of this description is working most satisfactorily at Cobalt, Ont. The system can be instantly changed from one to the other without any change of speed on the engine.

A plant had been installed at Cobalt, and when the writer arrived at the power station his first object was to thoroughly examine the plant then at work. He discovered that with very great difficulty and with constant poking and cleaning of the fire base, which had to be done about every hour, an engineer and a fireman managed to keep the engine running, carrying from 45 to 50 per cent. of its full load, the variation of speed being very considerable.

The new producer was installed about three days after the arrival of the writer, and in 1½ hours after the fire was started, the engine was carrying its full load, and inside of two hours, the gas became so rich that the gas admission valve on the engine had to be half closed, the explosion being so strong that the whole building shook.

The fires required no attention by the operator for a considerable length of time, thus relieving the fireman of a great deal of work.

A duplicate plant of precisely the same dimensions is now being considered by the purchasers. They are running a night and day service throughout.

(Continued in the July issue when Mr. Dymond will give a description and a test of the Coniagas mines instalation. —Editor.)

* Mechanical Engineer of Dymond Gas and Engine Co., Toronto.

# Recent Improvements in Canadian-made Grates

## Manufacturers Have made Several Important Improvements in their Grates, giving a Greater Economy in Fuel Consumption.

Several improvements have been made in the Cyclone grate which the manufacturer claims will add greatly to the life of the grates and give more economy in fuel consumption. The spaces in the centre of the grate are now ½ inch wide with ⅝ inch at the edge.

By referring to Fig. 2, it will be seen that there is a V cut on the end of the trunion giving the grate a jarring motion. This V rests on a flat place in the bar and the jarring motion imparted to the grate eliminates the use of a slice bar and does not allow ash or clinker to rest on the centre of the grate bars.

This arrangement of a V-shaped trunion lessens friction and makes the grate easier to rock, the trunion resting on two points only.

For large grates the shaking arm on section of grate is lengthened, giving a longer leverage. By these improvements the grate can be adapted to slack, anthracite or hard and soft screenings.

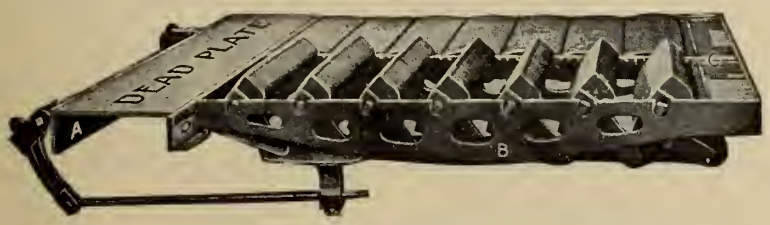



Fig. 1.—Cyclone Grate.

The cyclone grate is manufactured by the Canadian Steam Boiler Equipment Co., 36-38 Lombard St., Toronto.

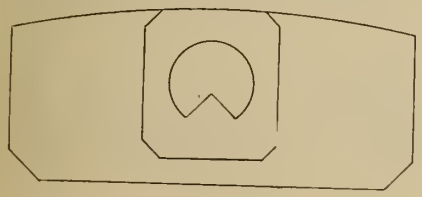


Fig. 2.—Improvements on Cyclone Grate.

### Fleming Grate Bar.

In the Fleming grate bar instalation, natural draft causes a continuous passage of air through the bars, over the bridge wall and into the combustion chamber where, heated to a temperature of 600 degrees F, it becomes united with the unused carbon causing a further combustion.

Fig. 3 shows the Fleming grate bar with the air conducting chamber. It is claimed for the grate that the continuous current of air keeps the bar comparatively cool, thus preventing the adherence of clinkers as well as preventing them from burning.

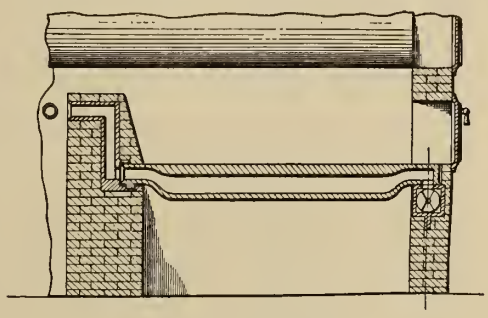


Fig. 3.—Fleming Grate.

Two evaporative tests were made at the works of the Ottawa Car Co., Ottawa, on Thursday, March 18 and Wednesday, March 24, 1909. The test in each case commenced at 7 a.m. and closed at 6 p.m., embracing eleven hours.

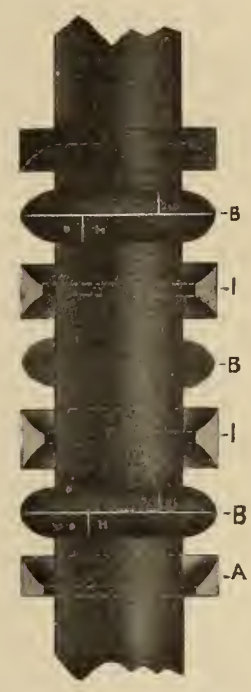
| | 18th Ordinary Grate. | 24th Fleming Grate. |
|---|---|---|
| Average temp. feed water | 175 deg. | 178 deg. |
| Average steam pressure | 115 lbs. | 114 lbs. |
| Wt. of cu. ft. of water | at 175 deg. 60. 66 | at 175 deg. 60. 59 |
| Total weight of water | at 175 deg. 37548.541 | 37141.77 |
| Coal consumed | 4420 lbs. | 3510 lbs. |
| Actual evap. per lb. coal | 8. 49. | 10.58 |
| Evap. from and at 212 deg. | 9.17 | 11.449 lbs. |
| By using Fleming Bars :— | | |
| Saving of coal in 11 hours | 900 lbs. | |
| Increased efficiency | 24½ per cent. | |

The Fleming grate bar is manufactured and is being placed on the market by the Butterworth Foundry Limited, 53 Queen St., Ottawa.

### A METAL PACKING.

The resumption of work by the Rhodes Improved Metallic Packing Co., which has taken over the business of the dissolved Rhodes Metallic Packing Co., puts on the Canadian market a metal packing which is, as claimed, an improvement on the packing originally produced.

Formerly this packing was made in one style only, for all uses and the construction was very heavy. The construction has been modified and lightened, and made now to suit the different conditions under which it will be used. For instance when used with steam the rubber backing does not come in contact with the rod while it does when used with ammonia.




Position of Metal and Rubber Rings on Rod.

The packing is constructed of rings of bearing metal which are moulded in three parts. These are placed around the rod by cutting one of the small copper wires which hold the three ring segments together. When the two rings are in place they present an elliptic form to the backing of rubber and the pressure of these rubber cushions automatically holds the rings against the rod. The packing is tightened by screwing the gland with the hand, never use a wrench.

The packing in manufactured by the Rhodes Improved Metallic Packing Co., 11 St. Nicholas St., Montreal.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Electricity and Steam.

W. G. Yorston estimates the cost of establishing an electric waterpower plant at Shelburne, N. S., at $30,000.

A syndicate headed by J. P. Charlebois has purchased a waterpower property at Collingwood, and propose to spend $100,000 in developing a plant.

The Tilbury Telephone Co. is ordering equipment for 40 miles of rural lines, work on which has been already commenced and which will be in operation this season.

The $135,000 loan for the extension of the electric lighting and garbage destruction plants has been approved by the Westmount, Montreal, Municipal Association.

The Ontario power commission purchased a site in St. Marys for a sub-station. St. Marys will require 1,500 horsepower from the Niagara power commission and power is expected for $29.50.

The Edgarton Tramway Company, Stellarton, N.S., is reported to have purchased the power plant of the New Glasgow Electric Company and proposes to move the plant from New Glasgow to Stellarton.

R. P. Moodie, chief inspector of the Ottawa Electric Co. has reported that the valuation on the Arnprior Electric Light & Power Co.'s plant is $23,000, which is considerably below the figures of that company.

Ald. James H. Sheppard, of Windsor, announced that that city would take 5,000 horsepower from the Niagara Power Union, of which from 3,000 to 4,000 h.p. would be used in the new Michigan Central tunnel.

The Victoria city council is calling for tenders for a brick, steel and concrete building to put a new lighting plant in as the capacity of the present plant is very much overtaxed, and a great many more lights are needed.

Mr. Wyse, formerly manager of the Brantford Electric and Operating Co., now of Toronto, has secured the subcontract for the erection of the telephone line in connection with the Hydro-Electric installation. The contract runs into nearly $100,000.

Hamilton will probably do the work of putting its fire and police alarm system wires under ground instead of making an arrangement with the Bell Telephone Company. The company estimated the cost for the cable at about $1,000 a mile, and it is said it would charge the city $264 a mile a year rental for the conduit. Mr. Barrow, consulting engineer, thinks the city can put the wires under ground for about $1,300 a mile.

The St. Thomas city council has been able to make a good bargain with the Bell Phone Co. through the efforts of the rural lines to get into that city. In the agreement just signed (which is for a three year exclusive franchise) the city gets $500 worth of free phones, a new building and over a mile of underground conduit work. The rural companies are to have connections at the most favorable rates. Work on the new building will commence at once.

The Dominion Railway Commission has issued an order establishing the right of independent telephone companies to connect their lines with railway stations, regardless of any exclusive agreement with other companies. The nominal fee of $1 per year is to be charged. The case came up in connection with applications from the People's Telephone Company, Sherbrooke, and the Caledon, Ont., Telephone Company, but the order is made general in its application.

The Morrisburg-Ottawa electric railway is a certainty unless something very unexpected happens. The right of way of the roadsides in each of the municipalities through which the line will pass has been obtained and the surveyors have started work on the laying out of the line. The grading will be completed by next fall, in order that the rails can be laid as early as possible next spring. Options have been obtained for electric power from Morrisburg, but the company will endeavor to buy a water power in the vicinity of Ottawa and develop its own energy.

The Toronto Electric Light Co. has inaugurated a temporary campaign of education by a display of Holophane reflectors and tungsten lamps. Of the Holophane reflector, Mr. Pendleton, the lecturer, stated they were designed to meet the present day demand for a compact line of reflectors for storekeepers. The reflectors are designed upon the new prism principle. As a result of many improvements a reflector of pleasing design and higher efficiency than any heretofore manufactured is the result. The tungsten electric lamps are of 48 and 80 candle power respectively. They give a pure, white light, which is reliable enough for matching colors.

## Gas Items.

Barrie ratepayers will again vote on a by-law to assist the Weber Gas Engine Co. to locate there.

The Acadia Gas Engine Company, Lunenburg, N.S., have recently shipped a 4 b.p. gas engine to Charles Harlow, Halifax.

The Rondeau Oil and Gas Co. has made application to the Windsor city council for a franchise at somewhat lower rates than the Volcanic company proposes.

H. E. Simms, representing the Olds Gas Power Co., of Lansing, Mich., whose Canadian branch is in Sherbrooke, Que., has established a Maritime branch at Moncton, N.B.

A Vancouver company, headed by C. E. Del, has purchased the Nanaimo Gas Company's holdings for $20,000. The new company is capitalized at $100,000, and will be known as the Nanaimo Light, Heat & Gas Power Company.

"East Tilbury Oil Fields, Limited," the new English syndicate which recently acquired extensive holdings in the Tilbury East oil fields, is preparing for comprehansive development of the field. Twenty-five new wells will be started in the immediate future.

An automatic gas lighting plant having a capacity for three hundred lights, made by the Monitor Manufacturing Company, Fredericton, will be installed in the Colonial Arms hotel at Deep Brook, N.B. This is said to be the largest individual plant ever turned out in New Brunswick.

One hundred thousand dollars has been paid for the waterfrontage at Hastings known as the Black property, which lies on either side of the C.P.R. tracks, and north of the Hastings Park, by the Vancouver Gas Company. It is proposed to install there a large gas plant, sufficient to supply the increasing demands in the city.

David Forsythe, of Douro, Ont., has been offered $8,000 by a Montreal enternrise for the right of way on his farm for the purpose of making use of the natural gas there. Some time ago Mr. Forsythe was drilling for a well, when he discovered gas at a depth of of 82 feet, and gas was found in large quantities. Mr. Forsythe thinks there is a considerable quantity of gas in the section of Douro in which his farm is located.

Manager Oill of the St. Thomas light, heat and power depnrtment, submitted an abstract statement of the fourth anniversnry of that city's ownership of the power plant. During this time the department had paid out in lieu of taxes, $20,340.43. Debentures due to May 1 $60,160.33, making a total of $80,501.26. Taxes due $5,000, balance debenture debt $3,916.96, making a total of $8,916.96, which the department have sufficient funds to pay. The total amount for the four years, therefore, is $89,418.22. Five miles of gas mains had also been put down in that time, 1,000 gas meters had been purchased, a siding had been constructed all out of the current revenue. An ammonia plant had been built and the price of gas reduced from $1.50 to $1.00 and all this without a call from the people. The outstanding debenture debt, was now about $195,000 and the annual payments amounted to $16,000.

## Trade Notes.

James Beggs & Co., New York, have appointed the H. W. Petrie Co., Toronto and Montreal, Canadian agents for the Blackburn-Smith Feed Water Filter.

Edmond C. Rohson, formerly assistant secretary of the Magnolia Metal Company in their New York office, has been transferred to Montreal where he is now in charge of the Canadian office at 31 St. Nicholas Street.

The panelboards for St. Ann's Convent, Lachine, Que., are being furnished by the Hill Electric Switch & Mfg. Co., 1560 St. Lawrence Boulevard, Montreal. The wiring is being done by Picard & Lalonde, Montreal.

The Rhodes Improved Metallic Packing Co., Ltd., has been organized to take over the business of the Rhodes Metallic Packing Co. The officers of the new company are C. W. Spencer, president; D. W. Ogilvie, vice-president, and J. Fitzgerald, manager. The location of their office remains the same at 11 St. Nicholas St., near the Board of Trade, Montreal.

The Canadian British Insulated Company, Ltd., has been incorporated to carry on the Canadian business of the British Insulated abd Helsby Cables Ltd. The board of directors consists of Lawford Grant, president and managing director, J. J. Creelman, James Taylor, Dane Sinclair, A. Brooker and B. Webourn. The last three named being the English directors on the board and the first two, Canadian.

The Toronto Electrical Maintenance Co., 24 Adelaide St. West, Toronto, have established special departments for the inspection of power plants and electric light installations. Special attention will be given to the maintenance of power plants, which will be inspected periodically at a low rate, by contract. The company have also installed modern electrically-driven machinery for repair work. The management has been entrusted to Mr. T. W. Sheffield, A.M.I. E.E., who for five years was district manager for one of the largest branches in Great Britain of the General Electric Co., New York. Mr. W. H. Jackson, of Toronto, has been engaged as engineer.

## CATALOGUES.

MOTORS—Booklet "Textile Motor Talks" from Westinghouse Electric & Mfg. Co., Pittsburg.

STEAM PUMPS—Catalogue 72 from Dean Bros., Indianapolis, Ind., describing their steam and power driven hydraulic pressure pumps.

STEAM SPECIALTIES—Catalogue from Churchill-Lee Co., Detroit, Mich., describing injectors, check valves, lubricators, etc.

ECONOMIZERS—From B. F. Sturtevant Co., Bulletin 161 describing economizers for power plants of textile mills and 163 for steel mills.

STOKER—The Taylor Gravity Underfeed Stoker is fully described in a 40 page catalogue from the American Ship Windlass Co., Providence, R.I. Its application to various types of boilers is shown.

BATTERIES—An attractive booklet on the Gould Battery in Isolated Lighting Plants, issued by the Gould Storage Battery Co., Depew, N.Y., contains much information of value to electrical engineers and central station men.

MOTORS—Widely differing machines are driven by large direct current Crocker-Wheeler motors as described in Bulletin 113 just issued by the Crocker-Wheeler Company, Ampere, N. J. These motors are used on lathes, hoists, bloom shears, big rolls, and ammonia compressers. All important features of construction are clearly explained and are illustrated with photographs that give details of construction, and others showing the motors installed for actual service.

## The C. H. L. Keeler Co.

C. H. L. Keeler and J. A. Johnston have formed a partnership and under the name of C. H. L. Keeler Co., will carry on a business as manufacturers' agents with offices at 511 Continental Life Bldg., Toronto. This new firm are Canadian agents for H. Krautz Mfg. Co., Brooklyn, N.Y., makers of panels and switchboards; Duncan Electric Co., Lafayette, Mich., makers of transformers and meters; C. T. Doerring Co., Philadelphia, arc lamps, and Woolley Electric Co., enclosed fuses.

## New Canadian Carbon Company.

The Canadian National Carbon Co., with offices at 12, 14 and 16 Shuter St., Toronto, has been organized to better look after the Canadian trade in "Fabius Henrion" carbons. These carbons have been used for a number of years by leading central stations throughout Canada and the new company under the management of Alfred Landau. The company is prepared to furnish free samples for testing purposes to any interested party.

# Gas Engines
and
# Producer Gas Plants

BY MATHOT.

It is not only a guide for the engine designer, but covers exhaustively the fields of selection, purchase, installation and operation,—every part of the engine is clearly described in detail.

The following subjects are dealt with:—Principles of Gas Engines and Producer Design, Selection and Installation of an Engine, Conditions of Perfect Operation, Producer Gas Engines and their Possibilities, Care of Gas Engines and Producer Gas Plants, with a chapter on Volatile Hydrocarbon and Oil Engines.

**320 Pages** **175 Illustrations**

**Price, $2.50, Postpaid**

## TECHNICAL BOOKS
**10 Front St. East, Toronto**

# Snaps for Quick Sale

## MOTORS AND GENERATORS

| | | | | | | |
|---|---|---|---|---|---|---|
| 1½ | H.P., | 110 | Volt, | (J. & M.) | Motor | (Used). |
| 2 | " | 110 | " | " | " | " |
| 3½ | " | 500 | " | " | " | " |
| 6 | " | 500 | " | " | " | " |
| 8 | " | 500 | " | " | " | " |
| 7½ | " | 500 | " | (G.E.) | " | " |
| 15 | " | 500 | " | (U.E.Co.) | " | " |
| 25 | " | 500 | " | (J. & M.) | " | " |
| 150 | " | 500 | " | (U.E.Co.) | Generator | (New). |
| 400 | " | 3 phase | | " | " | " |

Also our own make of brand new generators and motors (made under Johnson patents) in all sizes, both for A.C. and D.C. circuits, from ¼ to 500 H.P. or larger. The only MULTISPEED motor made in Canada. The only D.C. and A.C. Generators that can remain on SHORT CIRCUIT indefinitely.

## Canadian Electrical and Motor Co.
Limited
468-474 King Street West, TORONTO
Main 2425

# The Dymond Gas & Engine Co.
LIMITED
## 131 Queen St. East, TORONTO

MAKERS OF

# GAS PRODUCERS
PRESSURE AND SUCTION

FOR ANTHRACITE COAL

## Pressure Bituminous Plants for Large Instalations

## HIGHEST THERMAL EFFICIENCY

AGENTS FOR

CROSSLEY BROS. GAS ENGINES—Vertical and Horizontal, all sizes and types
WILLIAMS-ROBINSON STEAM TURBINES

**If your present power is not satisfactory, advise us and we will help you out and guarantee results**

# Power Supply Markets

## VANCOUVER.

General conditions are encouraging. There is a marked activity in the logging industry, with camps starting up on different parts of the coast, and this feature is also noticeable in the interior, where the spring drive of logs is taking place. A good point is the announcement that the Kosmos liners are to call regularly at this port, while the Jehsen line, operating to Mexico, is to he put on a quicker service. All this increase in business means improved conditions for all concerned in the various lines of trade.

The Vancouver Gas Company is planning a large plant on the waterfront of Burrard Inlet, and has purchased for $100,000 property at Hastings, immediately east of the city proper. It is proposed to instal a plant that will meet the needs of the city for years to come.

## WINNIPEG.

Over 1,000 new orders for farmers' telephones have heen received hy the provincial telephone commission, this spring, and additional orders from the city are coming in every day. The construction department is heing taxed to the limits of its capacity.

Vice-president McNicoll, of the C.P.R., Montreal, has recently giaen out a contract to the Dominion Car and Foundry Company for the supply of 500 50-ton steel cars for delivery during the summer. The cars will he used to cnrry the coal traffic from the various coal mines to the prairie cities and towns, thus reducing the numher of hox cars which would have to be taken away from the grain transportation, to the hnulage of minerals in the autumn and winter.

The Brydges Engineering and Supply Co., of this city, have received an order from the C. N.R. for several tons of the Edgar Allan high speed tool steel of Sheffield, England.

Some recent contracts let to the Winnipeg branch of the Goldie-McCulloch Co., Galt, Ont., are, one horizontal Corliss engine of 1800 h.p., for Edmonton electric light plant, at a cost of $27,000; one vertical Corliss engine having a 14" cylinder, 28 x 30, with 500 h.p., for the McLeod electric light plant; two horizontal Corliss engines for the Rocky Mountain Cement Co., Blairmore, Alherta; one pair of Wheelock engines for the Thunder Bay Elevator Co., Port Port Arthur.

Among the many contracts that the Western Branch of the Canadian Westinghouse Co. are filling at present, is the electrical equipment of the large Fort Frances Door and Sash factory now under construction. The main line of work done hy Westinghouse here is electrical, they are however the hcadquarters for the Nearst lamp and, of course for the famous air-hrake. The local hranch is only a distrihuting station, nothing heing manufactured west of Hamilton.

LUBRICATING OILS—600 W. cylinders, 80c.; Maple Leaf cylinder, $1 per gal., 700 A. cylinder, 75c.; Sterling cylinder, 55c.; 600 A. cylinder, 50c.; Cnpital cylinder, 59 and 54c.; Solar red engine, 32c.; Atlantic red engine, 29c.; Standard gas engine oil, 36c.; Renown engine 38c.

GASOLINE—Engine gasoline, gal., 22½c.; f.o.h. Winnipeg, cases, $2.50.

## TORONTO.

The demand for power machinery is increasing and in addition to the large instalations heing made hy the manufacturers of engines and pumps in Ontario, a great deal of power machinery is heing imported. Engines and pumps nre being imported from England and electrical apparatus from Sweden, and England. Several instalations are reported hy Toronto agents of Swedish manufactured goods, among then: heing power plants at the Cohalt mines and in eastern Canada. The machines are of good design and suhstantially huilt.

The hoiler husiness has improved a great deal during the past month and a number of orders are reported. A great numher of return tuhular boilers are heing shipped to western Canada. The boiler husiness is the last to feel the upward movement of Canadian trade. The power equipment husiness is now in a very satisfactory condition.

BOILER TUBES—The following prices are quoted per 100 feet: 2-in. $8.50 to $8.75; 2½-in., $10.50 to $10.75; 3-in., $12.50; 3½-in., $15, nnd 4-in., $18 to $19.

LEAD WOOL—$10.50 per 100 lbs., $200 per ton.

FIRE BRICKS—Demand good. English and Scotch, $30 to $35; American, $27.50 to $35 per 1,000.

OILS—The demnnd has not varied since the last report. The demand has heen good with calls for good classes of luhricating oils.

## MONTREAL.

The general conditions in power supply lines continue to improve with a satisfactory steadiness and without any unhealthy or ahnormal acceleration. Reports from the various makers and dealers are encouraging, to say the least, with the ratio of orders closed to inquiries received on the upward trend. In the "steam specialties" trade husiness has livened up in the past month. One firm, with whom we had a chat, is very optimistic over the outlook. In one line alone (steam traps), they have, since the first of the year, closed over $4,600.00 worth of husiness and have propositions out covering ahout $8,000.00 more and indications are that at least 80 p.c. of these will amount to real orders. This is encouraging, and the activity in the other lines of steam accessories is quite hrisk. Power plants are being overhauled and owners seem to he paying more attention to the details of improvement which tend to lessen the operating expenses.

BOILER TUBES:—There is reported still a good deal of uneasiness among the mills in the United States and Europe which prevents any steadiness in import prices. The market is dull and when a hig order is in sight, that has to he filled from the mills, every one gets after it bouhd to secure it at any price; hence the price cutting.

Stock prices are steady as follows:—2-in. tuhes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

LUBRICATING OILS:—The market is steady with fair husiness doing.

The current prices (May 8th), are as follows:

Cylinder oils, (imp. gal.) 60c. to 80c.; engine oils, 30c. to 60c.; mnchine and dynamo oils, 30c. to 45c.; shaiting oils, 25c. to 40c.; luhricating greases (per lb.) 8c to 12c.

GASOLENE:—There has heen rather a heavy demand for this owing to the coming of fair weather and the increased use of automohiles.

The current pricc (May 8th) is 18½c. per gal., f.o.h. Montreal, cases $2.60.

GAS AND GASOLENE ENGINES:—These are moving well especially in the smaller sizes up to 20 h.p. There are many inquirics for producer and suction gas plants, which seems to indicate a growing interest in this form of prime movers.

LEAD WOOL:—The demand is increasing, due no doubt to summer work heing started hy municipalities on water works lines, etc. The importcd goods are quoted at 10 to 10½c. per lb. while the domestic holds at from 8 to 9c. per lb.

## BOOK REVIEWS.

DOMINION COAL CO.—An historical and descriptive hrochure of 128 pages hy F. W. Gray, As. Mem. Inst. E.E., illustrated, puhlished hy the Canadian Mining Journal, Confederation Life Building, Toronto. Price $1.00.

This book, compiled from articles appearing in the Canadian Mining Journal, contains descriptions of all the mines and collieries of the company and the mining methods employed in them. The fire-fighting and life-saving organizations and equipment are fully dealt with, as well as the cahin conditions, transportation facilities, etc., etc.

The following are the contents:

Chapter 1. General Description of the Sydney Coal Fields. II. The Mines of the Glace Bay Bnsin. III. The Phalen Seam. IV. The Harhor Seam. V. The Hub Seam. VI. The Emery Seam and Lower Seams of the Glace Bay Basin. VII. The Lingan—Victoria Areas. VIII. The Fire-fighting and Life-saving Organization and Equipment. IX. General and Transportation.

WHO MAKES WHAT—From Hardware Dealers' Magnzine, 253 Broadway, New York, a book of reference for huyers and makers, 10"x 6½", 368 pages, Price $1.00.

The book is a useful one containing a geographically, alphabetically arranged list of the names and addresses of more than twelve thousand manufacturers in all parts of the United States; also an alphahetically arranged list with thousands of headings and cross index headings, of the products of goods produced hy more than twelve thousand manufacturers, showing (as the title indicates) "Who Makes What."


HERCULES Seamless Copper FLOATS
Are Absolutely Reliable

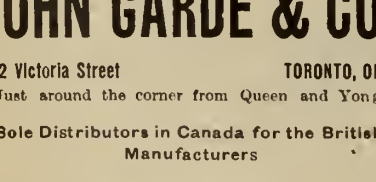
We guarantee every one to give you entire satisfaction.

We will send you our new CATALOG "C" on request.

Hercules Float Works
P.O. Box 396. Springfield, Mass.

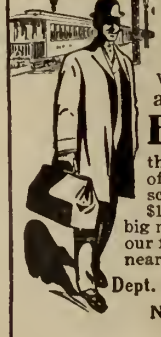
JOHN GARDE & CO.
142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND



BE A SALESMAN
We will teach you to be an Expert Salesman in eight weeks by mail, and assist you to secure a position with a reliable firm. Through our
Free Employment Bureau
the largest of its kind in the world, we have placed hundreds of our Graduates in good paying positions, and always have scores of good openings. Traveling Salesmen earn from $1,000 to $10,000 a year and expenses. If you want to make big money, fill out and mail the attached coupon today for our free book "A Knight of the Grip," Address our nearest office.
Dept. 360 National Salesman's Training Association
New York Chicago San Francisco
Kansas City Minneapolis
Name ..... P.O. ..... State ..... R.F.D. ..... 360

# Machinery Wanted and For Sale

## Rates for Condensed Advertising

Adverti-ements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

ELECTRIC

BARGAINS

| | | | |
|---|---|---|---|
| 7½ | H.P. | A.C. Motor | (Westinghouse) |
| 3 | " | " | " |
| 3 | " | " | (C.G.E.) |
| 7 | " | D.C. " | (Diehl) |
| 15 | " | " | (Kay) |
| 175 | Light | Dynamo | (Eddy) |

We manufacture alternating and direct current motors in all sizes. Repairs promptly performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Toronto, Ont.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 b.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

WESTON & CO., 128 Seaton Street, Toronto, offer for prompt shipment, subject to prior sale :

One 10-in. x 28-in. Wheelock engine—latest pattern.

One 14-in. x 34-in. Wheelock engine—latest pattern.

One 14-in. x 24-in. left-hand engine—in fine order —cheap.

One 6-in. x 6-in. automatic C.C. engine—bargain.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

Transmission Machinery—Write us for prices on shafting, hangers, pulleys, etc.; will promptly figure on any specifications submitted.

Flour Mill Machinery.

The Brown Automatic Engine.

Boilers.

The STRATFORD MILL BUILDING CO., Ltd., Stratford, Ont.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta.

### For Sale

A 3 h.p. 2 phase 110 volt 66 cycle Canadian General Electric Motor, in good shape—a bargain. Also a 5 h.p. and a 15 h.p. Motor, and transformers in stock.

NORTHERN ELECTRIC SUPPLY CO.,
(5) Orillia, Ont.

### For Sale

FOR SALE

Canadian Patents on Steam Traps

which includes a line of Separating Traps, Direct Return and Vacuum Traps. Address

**Taylor Steam Trap Company**
Battle Creek, Mich, U.S.A.

## Levy & Westwood Machinery Co.

Have the following for sale:—

**REFITTED HORIZONTAL RETURN TUBULAR BOILERS**

1—72" x 13'6"
1—44" x 13'6"
2—54" x 12'
1—54" x 14'
1—44" x 11'6"
1—54" x 8' Clyde Style, on skids.
1—54" x 8' Clyde Style.

**REFITTED UPRIGHT BOILERS**

1—48" x 94"—104-2" tubes.
1—46" x 72"—100-2" tubes.
1—42" x 80"— 86-2" tubes.

**REFITTED PORTABLE ENGINES AND BOILERS**

1—10 H.P. Cornell on wheels.
1—12 H.P. Waterous on wheels.
1—12 H.P. Whitelaw on skids.

**REFITTED SAW MILL ENGINES**

1—15" x 18" stroke.
1—13" x 18" stroke.
1—10" x 16" stroke.
1—10" x 14" stroke.
1—9½" x 12" stroke.
1—9" x 16" stroke.
1—8" x 12" stroke.
1—6" x 10" stroke.
1—40 to 50 H.P. Hardill Compound.
1—25 H.P. Hardill Compound.
1—18 H.P. Automatic Horizontal Engine.
1—35 H.P. Automatic Vertical Engine.
1—Twin Vertical Marine Engine 3½"x4" cylinder.
1—MacGregor Gourlay Bolt Cutter up to 1½".
1—Jno. Bertram Bolt Cutter up to 1¼".
3—Pipe Threading Machines up to 3".
1—40" Lefell Water Wheel.
1—18" Little Giant Water Wheel.
1—16" Little Giant Water Wheel.
1—Pair of Mortise Bevel Gears 48" and 24"—6" face.
1—24" x 6" Double Surfacer and Matcher,, Mnfrd. Major Harper.
1—24"x4" Goldie & McCulloch Planer & Matcher.
1—24" x 6" Cant Planer and Matcher.
1—30" x 6" Smoothing Planer.
1—26" x 10" Double Surfacer Planer.
1—24" x 8" Revolving Bed Surface Planer.
1—MacGregor Gourlay Double Cut Off Saw (Roller table.)
2—Double Gear Hand Hoisting Winches.
50' of new 1¼" Marlin Wound Steam Hose.

**SUPPLIES OF ALL KINDS**

PHONE M. 1375

Address:—

## Levy & Westwood Machinery Co.

102 FRONT ST. WEST · TORONTO

### SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

Russell & Gifford, Montreal

## Boiler Compounds.

The "Skaleoff" Co., Montreal

## Boiler Feed Pumps.

Canadian Steam Boiler Equipment Co., Toronto

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boilers.

Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

## Castings, Brass.

Hercules Float Works, Springfield, Mass

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co., Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Galt & Smith, Toronto.
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Crank Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Gas Producer Plants.

Bain & Mitchell, Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Peiler & MacKenzie, Montreal

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Grates.

Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Peterboro Lubricator Mfg. Co., Peterboro

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

## Lubricators, Force Feed.

Darling Bros., Montreal
Sight Feed Oil Pump Co., Milwaukee, Wis

## Mechanical Stokers.

Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

## Meters, Water and Electric.

Peiler & MacKenzie, Montreal

## Mill Machinery.

Allis-Chalmers Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg. Co., Lindsay, Ont
Waterous Engine Works Co., Brantford

## Mining Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Oilers, Gang.

Sight Feed Oil Pump Co., Milwaukee, Wis

## Oil Filters

Darling Bros., Montreal

# One Moment Please

## Are You Obtaining the best Results From Your Boiler?

¶ You can get 100 cents worth of steam for every dollar's worth of fuel, providing your boiler is clean and in good condition.

¶ "SKALEOFF" will positively remove and prevent scale and will preserve the boiler and packing.

¶ "SKALEOFF" can be kept in the boiler as long as you may require to keep the boiler closed. There is no need of changing the water except when cleaning out the boilers.

¶ "SKALEOFF" does not contain any strong corroding ingredients, such as acid-salts, caustics, slacked lime, soda ash, etc.

¶ "SKALEOFF" positively will not eat packing or scratch the various engine or pump rods, it will not ruin valves or joints, it will not cause a leaky boiler either at a seam, joint or rivet.

¶ We will be pleased to furnish, free of charge, enough "SKALEOFF" to make a thorough test.

¶ There is satisfaction in every barrel and our guarantee goes with every barrel you get.

¶ *Send for particulars and have a free test made in your own boilers under your own conditions. Don't take our "say so" let us SHOW you.*

## The "SKALEOFF" CO.

65 Shannon Street

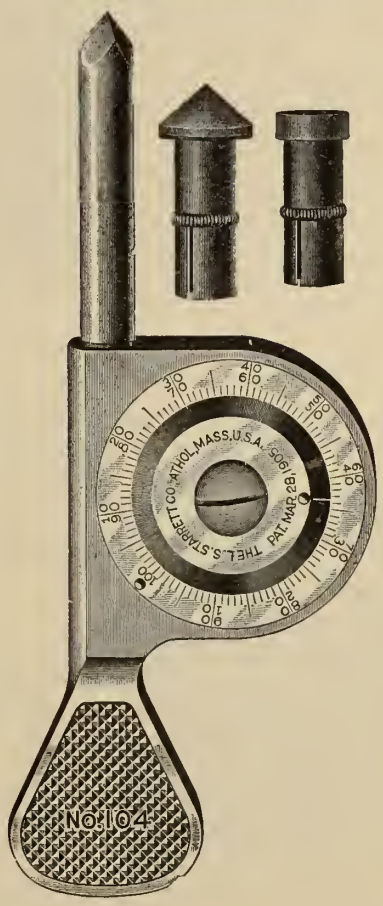
Montreal



# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

**PUBLISHED MONTHLY AT $1.00 PER YEAR.**
**Start in TO-DAY to earn one of these handy Tools.**

## THE POWER HOUSE

10 Front Street East TORONTO

### Oil Separators.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Packing, Metallic.

Rhodes Improved Metallic Packing Co. Montreal

### Panels, Electric

Hill Electric Switch Co., Montreal

### Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pipe Threading Tools.

Borden-Canadian Co., Toronto.

### Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Power Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

### Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.

### Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros , Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pump Strainers.

Canadian Steam Boiler Equipment Co., Toronto

### Pumps, Oil.

Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.

Goldie & McCulloch Co., Galt.

### Safety valves.

Peiler & MacKenzie, Montreal

### Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,

### Shaking and Dumping Grate

Standard Engineering Co., Toronto

### Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto

### Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

### Steam Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Standard Engineering Co., Toronto
Waterous Engine Works Co., Brantford

### Steam Specialties.

Darling Bros., Montreal
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.

Darling Bros., Montreal
Standard Engineering Co., Toronto
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal

### Switches, Electric

Hill Electric Switch Co., Montreal

### Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co., Montreal

### Tanks, Blow-off

Darling Bros., Montreal

### Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

### Tests and Inspections.

Bain & Mitchell, Montreal

### Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal

### Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd , Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

### Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

### Unions

Dart Union Co., Toronto

### Vacuum Governors.

Canadian Steam Boiler Equipment Co., Toronto

### Vacuum Pumps.

Canadian Steam Boiler Equipment Co., Toronto

### Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Valve Reseating Machines

Darling Bros., Montreal

### Valves.

Canadian Steam Boiler Equipment Co., Toronto
Kerr Engine Co., Walkerville, Ont.
Standard Engineering Co., Toronto.

### Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

### Watt Meters.

Gas & Electric Power Co., Toronto.

---

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock ..... inside front cover
Audel & Co., Theo ..... 45

**B**

Beauhien, De Gaspe ..... 48
Brownell Co ..... 10
Butterworth Foundry Co ..... 9

**C**

Canada Chemical Mfg. Co ..... 7
Canada Gas Power & Fuel Co ..... 6
Canada Metal Co ..... 10
Canadian Association of Stationary Engineers ..... 47
Canadian Electric & Motor Co ..... 39
Canadian Instrument and Testing Co ..... 46
Canadian Steam Boiler Equipment Co ..... 8

**D**

Darling Bros ..... 1
Dart Union Co ..... 10
Death & Watson ..... 48
Diamond Grate Bar Co ..... 4
Dymond Gas and Engine Co ..... 39

**E**

Electrical Maintenance & Repair Co .... inside back cover

**F**

Farmer, John T ..... 48
Featherstonhaugh ..... 48
Francis, Walter J ..... 48

**G**

Galt & Smith ..... 48
Garde, John, & Co ..... 40
Gas & Electric Power Co ..... 2
Goldie & McCulloch Co ..... 12
Goodhue, J. L., & Co ..... 7
Goold, Shapley & Muir ..... 3

**H**

Hercules Float Works ..... 40
Hill Electric Switch Co ..... 48

**J**

Jenckes Machine Co ..... 3
Jones & Moore Electric Co ..... 41
Jones Underfeed Stoker Co ..... 6

**K**

Kerr Engine Co ..... 47
Kilmer, Pullen & Burnham ..... inside back cover

**L**

Leonard, E., & Sons ..... 3
Levy & Westward ..... 41

**Mc**

McLaren, D. K., Ltd ..... 5
McLeod & Henry Co ..... 46
McRae, J B ..... 48

**M**

Merrill, Edward B ..... 48
Mitchell, C. H. & P. H ..... 48
Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

**N**

National Salesmen Training Association ..... 40

**O**

Oliver, W. H. & Co ..... 2

**P**

Packard Electric Co., Ltd ..... 45
Peiler & MacKenzie ..... 6
Penherthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 9

**R**

Rhodes Improved Metallic Packing Co ..... 8
Rohh Engineering Co ..... 11
Robertson, Jas. L., & Sons ..... 45
Robertson, J. M ..... 48
Russel & Gifford ..... 47

**S**

Sadler & Haworth ..... 7
Sammett, M. A ..... 48
Shanly, J. M ..... 48
Sight Feed Oil Pump Co ..... 47
Skaleoff Co ..... 43
Smith, Kerry & Chace ..... 48
Standard Engineering Co ..... 1

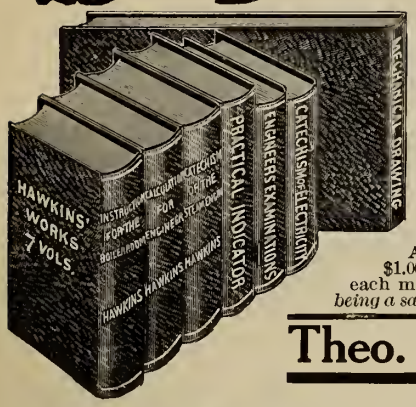
**T**

Taylor Steam Trap Co ..... 41
Technical Books ..... 48

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 11

*Hawkins Works*




## On Easy Payments.

Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,268 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

SPECIAL OFFER Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month *(when complete set is purchased the price is $12, being a saving of One Dollar)*. **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

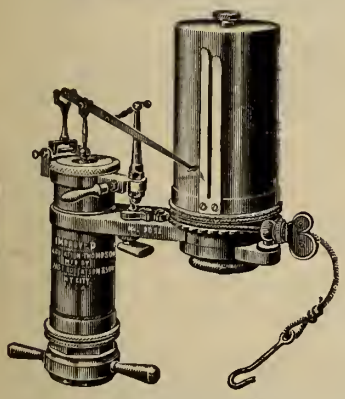
| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed. ..... (Firm Name)

Home Address .....



A REMARKABLE OFFER

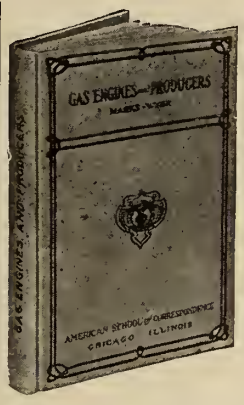
## Robertson Thompson Indicator and Victor Wheel

## $45

**$10** down, **$5** per month. No mortgage, simply good references.

**10%** off cash with order. Indicator **$35**, Wheel **$10**, Willis Planimeter **$12.50**, on the same basis. Let us send some testimonals, 10 years use.

**Jas. L. Robertson & Sons**
78-80 Murray St., New York




## The Gas Engine in Principle and Practice

*By A. H. Goldingham*

***Price $1.50, Postpaid***
***195 Pages, 107 Illustrations***

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

***Technical Book Department***

**The MacLean Publishing Co., Ltd.,** 10 Front St. East, Toronto

# THE WATER TEST

## *Packard*

## Type "D" Motor

Reproduction from an actual photograph, showing the "Water Test" as applied to a Packard Type "D" Motor.

shown in the picture, proves one of the many points about the PACKARD Type "D" Motors, that combines to make them peculiarly adaptable for severe operating conditions.

The test consisted of a submersion of the motor in a tank. Connection being made to the circuit, the motor was allowed to run—completely under water- for several hours at a time— and, after repeated tests, the insulation was found to be in no-wise affected.

Could you ask better proof of the **ruggedness of design** and **careful construction** of the motor; or of the success of our Vacuum process of insulation?

# The Packard Electric Co., Limited

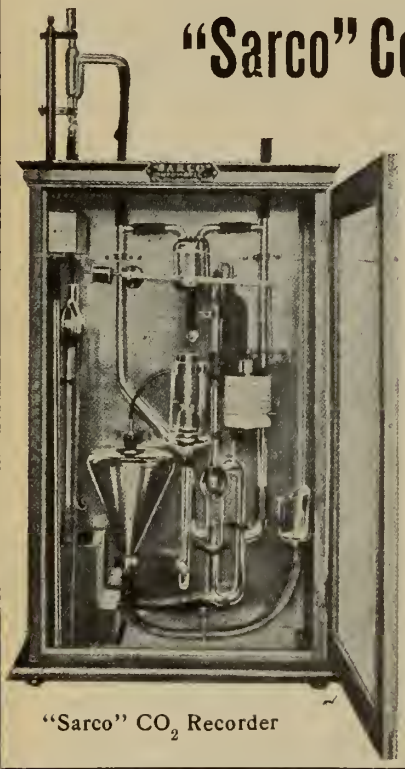
Head Office and Works
**St. Catharines, Ont.**

Branch Offices
**Montreal and Winnipeg**

# Keep Tab on Your Fuel Combustion

*by using a*

## "Sarco" $Co_2$ Recorder



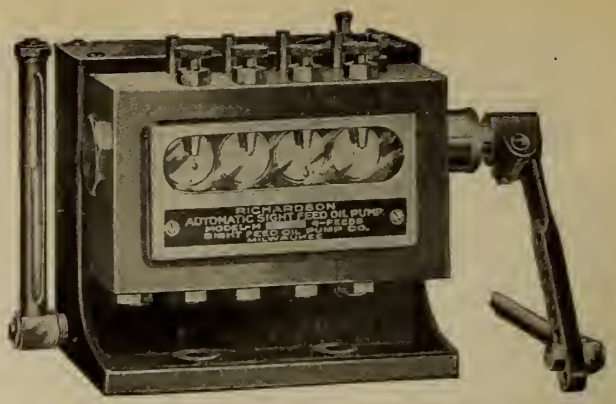
"Sarco" $CO_2$ Recorder

Tells at a glance, upon an exposed chart, the exact percentage of carbon dioxide ($CO_2$) in the flue gases of your boiler furnaces. The nearer you get to 20% $CO_2$ in these gases the nearer you are to complete combustion and the Recorder is made to keep you informed.

WANT PARTICULARS?

**CANADIAN INSTRUMENT & TESTING CO.**

MONTREAL




# Lubrication Now Costs Less

Cut shows the Richardson Sight Feed Oil Pump, Model "M," which reduces the expense of lubricating engine or compressor cylinders.

Here's how the saving is effected:

The action is automatic. Entirely. Moreover, it's positive. Delivers oil to the Steam every revolution of the engine.

Then it means less wear on the cylinders and reduction in operating expenses.

Has no frail or complicated parts. Nothing to wear out. Successful *all* the time.

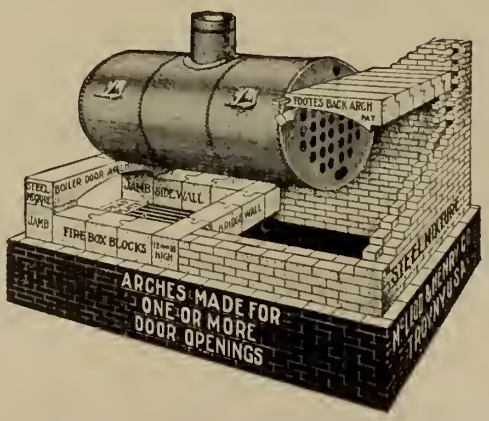
*Bulletin No. 209-L is important. Send for it.*

**Sight Feed Oil Pump Company**

MILWAUKEE, WIS., U. S. A.

# "STEEL MIXTURE"

BOILER DOOR ARCHES, FIRE BOX BLOCKS, or BACK COMBUSTION CHAMBER ARCHES made of this celebrated material are being used in thousands of Power Plants to-day.




They have won popularity simply because they give satisfactory service. Their use reduces the cost of power. Get our "Dimension Blanks" and let us quote you prices. : : : : :

NEW YORK CITY BRANCH, 1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS, TROY, N.Y.

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

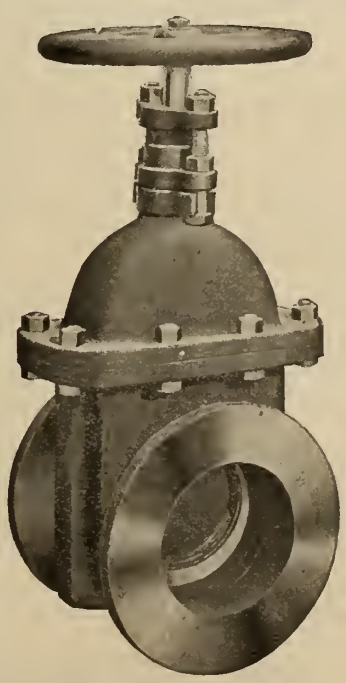
The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

Sales Agents
# "BUNDY"
TRAPS

Manufacturers
# "WING"
BLOWERS

**RUSSEL & GIFFORD**
505 Power Bldg.
MONTREAL.



## *KERR GATE VALVES*

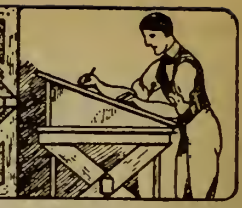
***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

***The Kerr Engine Co., Limited***
***Valve Manufacturers***
***Walkerville, - Ontario***

# PROFESSIONAL DIRECTORY



**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS' BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**SMITH, KERRY & CHACE**
ENGINEERS
Hydraulic, Steam, Electric, Railway, Municipal, Industrial
W.U. Code used. Cable Address "Smithco."
TORONTO — Cecil B. Smith
WINNIPEG — J. G. G. Kerry
CALGARY — W. G. Chace

**CONSULTING AND SUPERVISING ENGINEERS**
You should have your card appear regularly on this page—you may miss important engagements by not being represented.

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street Toronto

---

**SWITCH-BOARDS**
Avail yourself of our
**Experience and Facilities**
in switch-board construction
**The Hill Electric Switch and Mfg. Co.**
1561 St. Lawrence Street, - Montreal

**WATER POWER**
By J. P. Frizell
An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.
658 PAGES 251 ILLUSTRATIONS
**Price $5.00, postpaid**
**MACLEAN PUBLISHING COMPANY**
TECHNICAL BOOK DEPARTMENT
10 Front St East - - Toronto

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419



# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

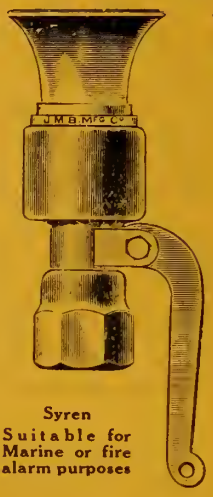
**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

We Make the Largest Variety in

# Steam Whistles

Long Bell Plain Whistle, without valve, all sizes 1" to 10" Bell

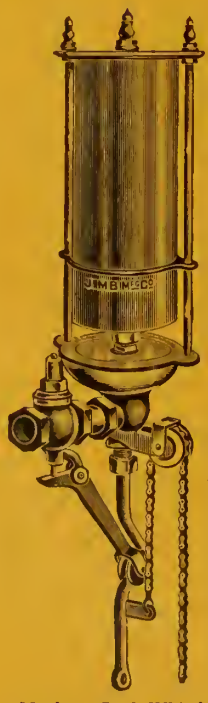
Long Bell Plain Whistle with compound automatic valves for high pressure, made all sizes 4" to 12" Bell.




Syren
Suitable for Marine or fire alarm purposes

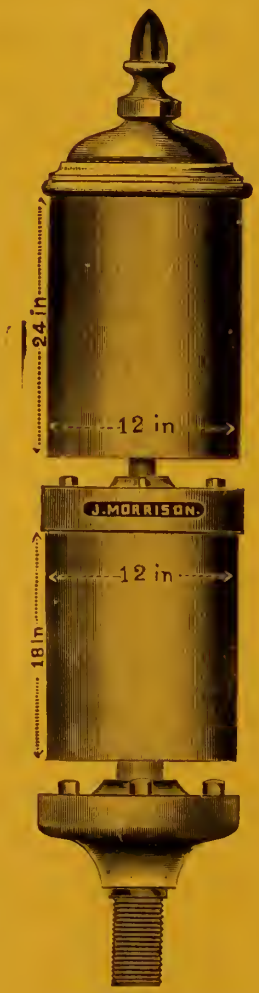
Long Bell Plain Whistle with standard valve made all sizes 2" to 12" Bell

Two-chamber Organ Whistle




Mocking Bird Whistle with chain operating attachment.

All whistles are made of seamless drawn whistle tube with full-weight cast brass mountings.




Double Bell Harmonium Whistle
made with bells 6" to 14" diameter.

We have other styles of whistles:—
Combination whistle chimes.
Extra heavy locomotive and marine whistles.
Air whistles, etc.

Single Bell, Three-chamber Chime Whistle, with valve.
Made all sizes of Bells 2" to 12" diamater

We can furnish you with anything in the whistle line from one inch diameter to fourteen inches, for pipe connection from ¼ inch to 3 inches.

## The James Morrison Brass Mfg. Co., Limited

93-97 Adelaide Street West, TORONTO

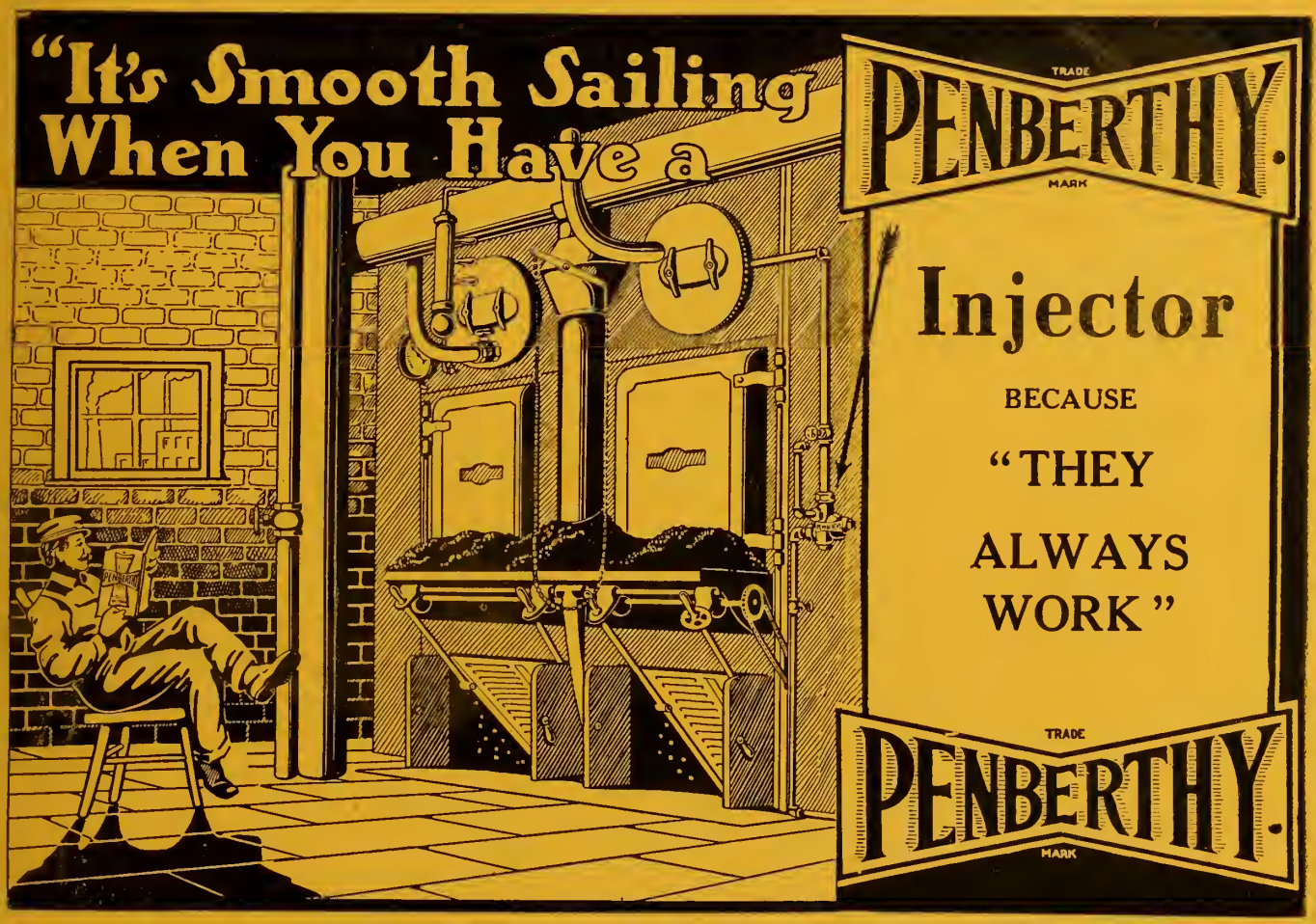
BOILER NUMBER

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C

Vol. II. Publication Office, Toronto—June, 1909 No. 6




## BOILER ROOMS

equipped with Genuine Penberthy Injectors means to the Manufacturer

"ECONOMY IN COAL CONSUMPTION"

Means to the Engineer in charge

"CONFIDENCE AND SATISFACTION"

THE BOILER FEEDER THAT MEETS ALL DEMANDS.

PENBERTHY INJECTOR CO., Limited, WINDSOR, ONT.

# PUMPS ! PUMPS !

FOR THE

# POWER HOUSE

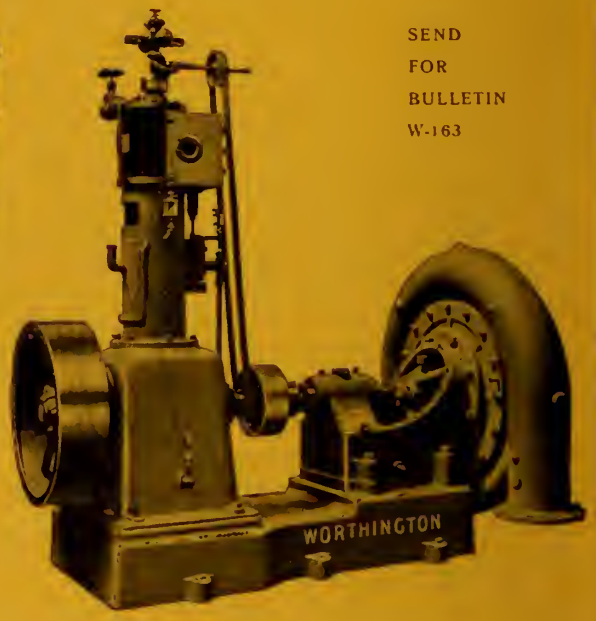
PISTON PATTERN PUMPS

DESIGNED ALSO FOR BOILER FEED, FIRE, HYDRAULIC, ELEVATOR AND FOR GENERAL SERVICE.

SEND FOR BULLETIN W-163

CENTRIFUGAL PUMPS

*A Steam Driven Volute Pump for supplying water to surface condenser*




*SEE BULLETIN 104*

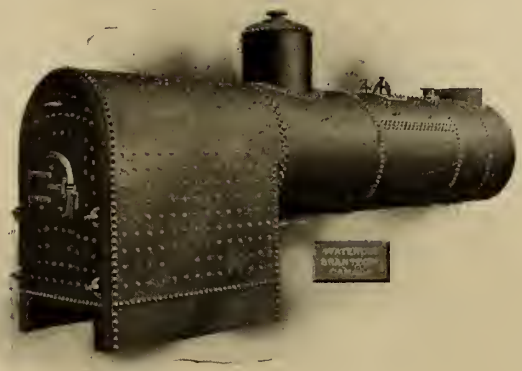
## THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO.

LIMITED

**WORKS--Montreal**

**Sales Offices : MONTREAL, TORONTO, COBALT, WINNIPEG, CALGARY, VANCOUVER**

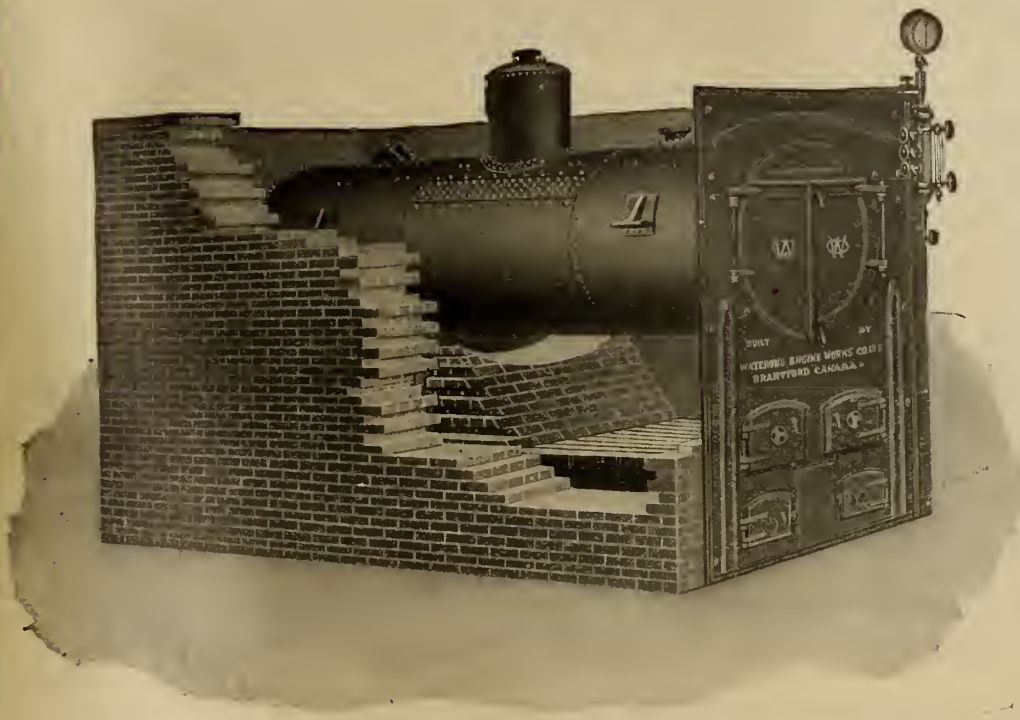
# POWER PLANTS



**Locomotive Boilers**

Built under the British Columbia Boiler Inspection Laws.

10 H. P. to 150 H. P.



**Standard Tubular Stationary Boilers**

The cut represents this style of boiler with ordinary full front setting. Half front and different styles of oven settings can be furnished if desired.

These boilers are built for various pressures and from 10 to 200 horsepower.

We manufacture: Boilers, all types; Stationary, Marine, Automatic, Simple and Compound Engines; Steam Plant Accessories.

**Write for Bulletin and Prices**

## The Waterous Engine Works Co., Limited

**BRANTFORD, - ONTARIO**

**Western Branch: Winnipeg, Man.** **B.C. Agent: H. B. Gilmour, Vancouver**

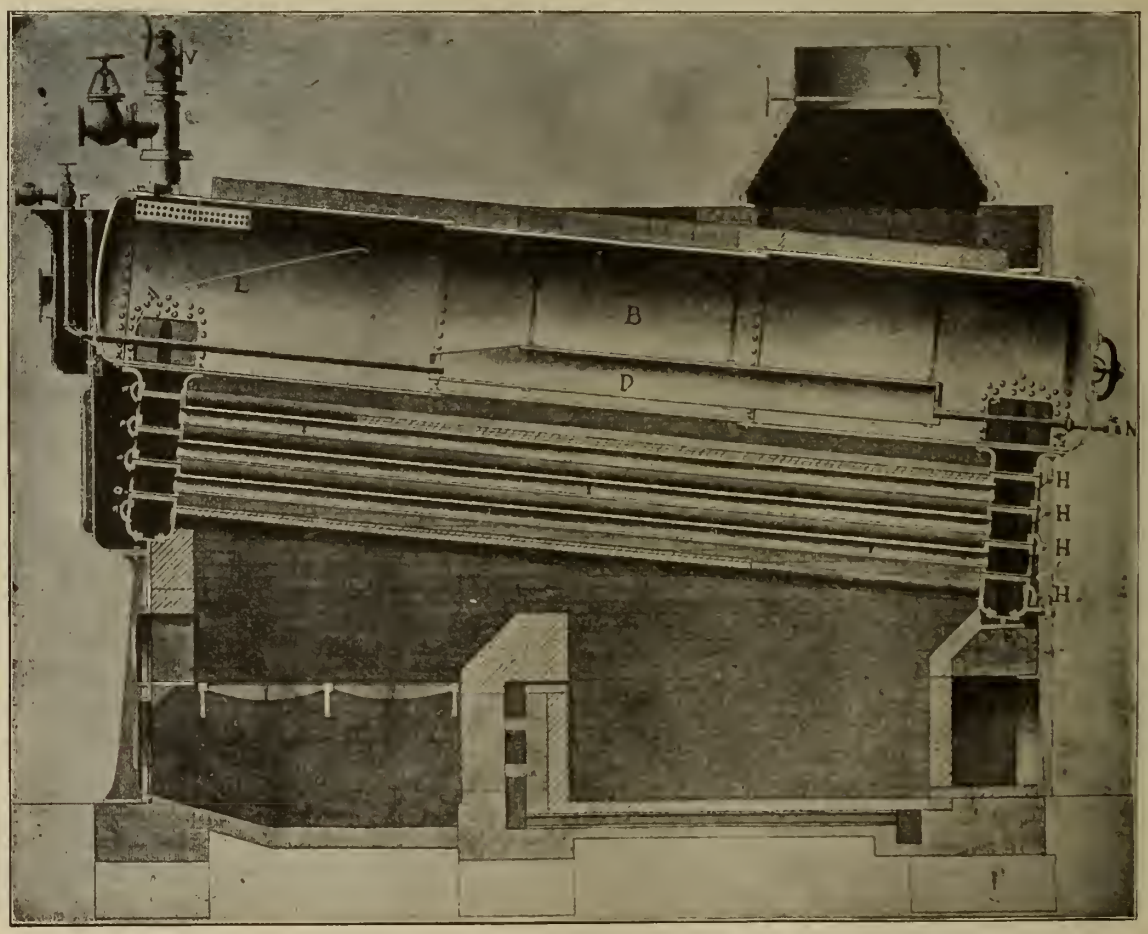
# Heine Safety Boilers

are unquestionably the

## Safest and Most Efficient

In the Heine Boiler Furnace the nest of parallel tubes are wholly within the combustion chamber, exposed at every point to the products of combustion as those products pass from the flue to the stack. This feature causes the Heine Boiler to rank first in economy and capacity.

The construction of the Heine Water Tubes and Water and Mud Drums is such that a constant and uninterrupted circulation of the water is maintained at all times. There are no obstructions, sharp turns or vertical tubes; and the throat openings are 90 per cent. of the aggregate tube area.



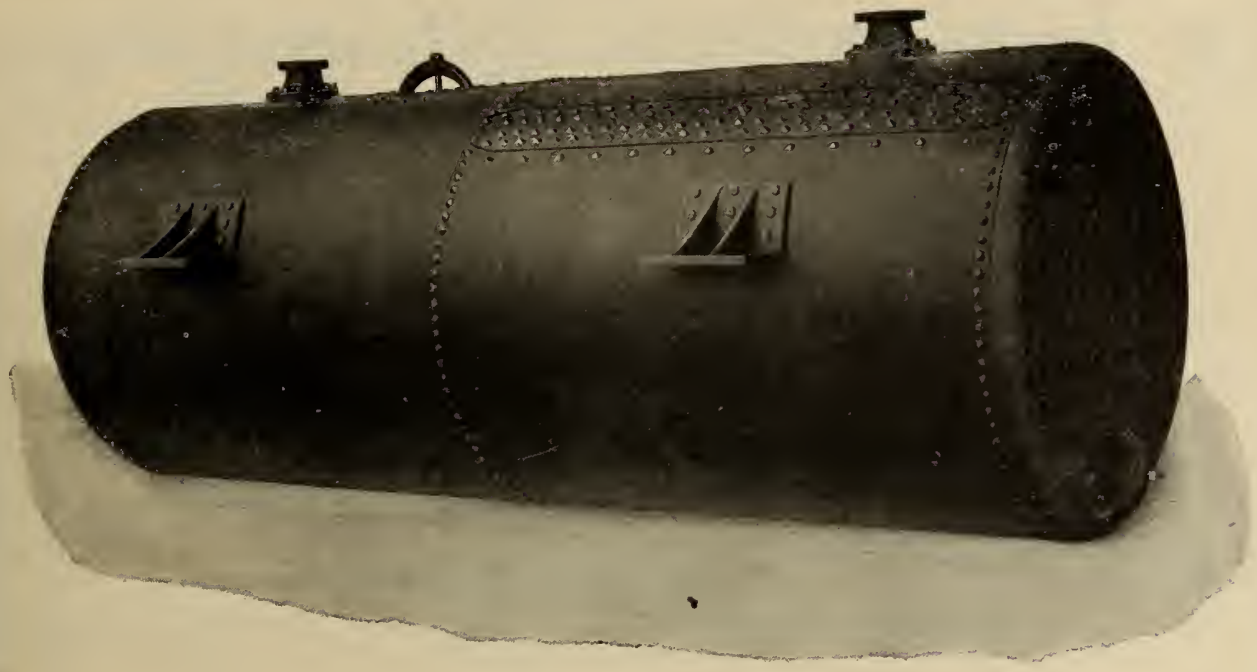

Not a little of the immense popularity of the Heine Boiler is due to its absolute safety. Absolute safety is secured by the qualities of the materials, the workmanship, the proper arrangement of the parts, avoidance of unequal expansion and contraction, accessibility for cleaning and repairs.

No cast iron is used in any parts subject to tensile stress. The Boiler Plates are Homogeneous Steel, made by the Open Hearth Process, having a tensile strength of 55,000 to 62,000 lbs. per square inch. Every plate used is subjected to bending, hammering, chemical and other tests of the utmost severity.

*There are scores of other points in connection with the Heine Boiler which are of vital interest to every power user and engineer. Write us to-day for our illustrated, descriptive circular.*

# Polson Iron Works, Limited

## Toronto, Canada



# BOILERS

Horizontal Tubular
Vertical Tubular
Locomotive Types
Medium and High Pressures
All Sizes
Heating Boilers
Complete Steam Power Plants
Write us for Quotations
Send for Our New Catalog

## The Jenckes Machine Co., Limited

WORKS:

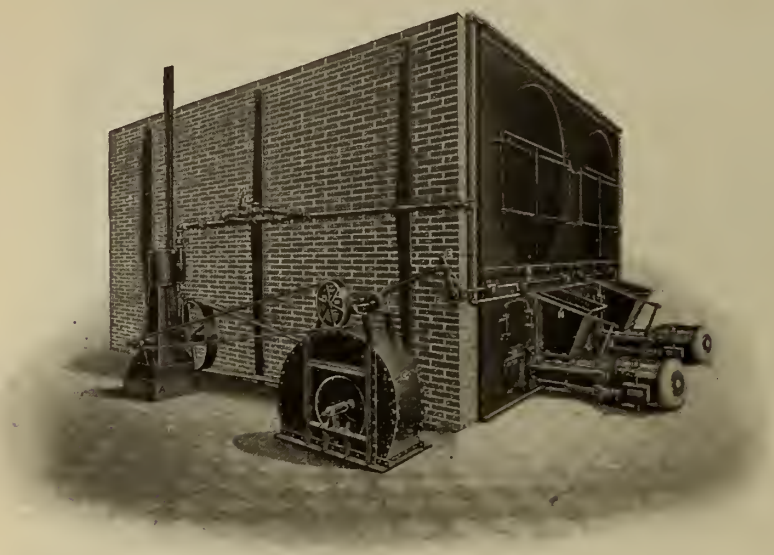
Sherbrooke, Que. St. Catharines, Ont.

SALES OFFICES:

Sherbrooke Montreal St. Catharines Cobalt Vancouver

Kindly address nearest Sales Office.

# The Jones Automatic Mechanical Stokers



**Have FOUR DISTINCT ADVANTAGES Over Any Other Method of Firing:**

1st—The coal is fed into the furnace from underneath, and the high percentage of volatile matter in Bituminous coal is compelled to find its way through a bed of burning coke, which assures the entire utility of ali volatile combustible matter in the fuel.

2nd—The coal is uniformly fed into the furnace in direct proportion to the demand for steam, by means of the automatic feeding device.

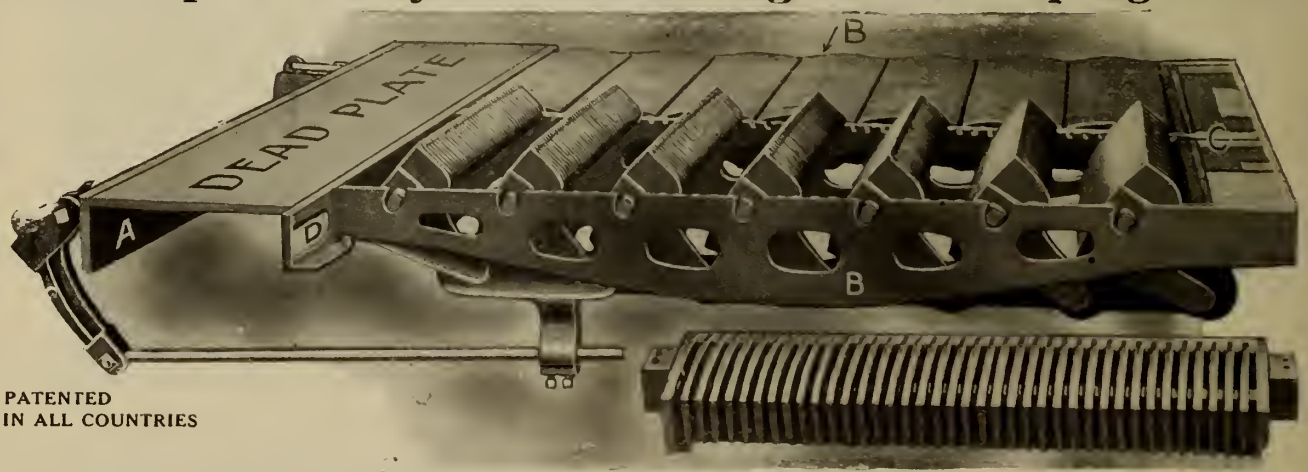
3rd—A definite supply of air, automatically proportioned to the amount of coal being burned and just sufficient to maintain complete combustion, is supplied to the furnace automatically.

4th—A smokeless stack is maintained because of the furnace economy, due to complete combustion.

## JONES UNDER-FEED STOKER COMPANY
LIMITED

TORONTO MONTREAL

# The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES

We have recently improved the Cyclone Grate, adding three most important features to it, which increases its fuel-saving qualities and the life of the bar, also making it shake more easily.

Copy of letter received from Cornwall and York Cotton Mills Co., Ltd., whose battery of six boilers are equipped with Cyclone Grates.

F. W. Blizard, Esq. St. John, N. B. Saint John, N.B., April 26th., 1909.

Dear Sir;—Replying to your favor of the 24th instant re Cyclone Grate Bars, my opinion of these bars is higher, if possible, to day than when I wrote them on February 24th, 1908. They have given most excellent satisfaction and are the best grate bars that I have ever personally seen.

At Easter we happened to be making some repairs to the brick work of the furnace in which the first set of these bars that we bought were installed. I examamined the bars carefully when they were out, and as far as one could see, there was not the slighest evidence that they had ever been in service bevond their color. These bars, I think, have been under the boiler and in steady service twenty-four hours a day for probably three years at least. I do not remember exactly when they were put in, but I think between three and four years ago. Yours truly, Signed—John B. Cudlip, Manager.

***Write for Circular and Full Particulars***

## Canadian Steam Boiler Equipment Company, Limited
**36 and 38 Lombard Street : : : : : : : : : : Toronto**

# New Model "Diamond" Shaking and Dumping Grate Bar

*By using Diamond Grates you increase your power from 5 to 20%*

*The Diamond Grate is applicable to any type of boiler and to units of any size.*

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal. The following points are convincing proofs of its money-saving quality:

**Simplicity and durability**
**Economy in fuel**
**Best draft grate in the world**
**Has 90% under draft**
**Will not lock or bind in frame**
**Always shakes freely**
**Elimination of heavy clinkers**
**Perfect Bar for internal fire boiler**
**Fire easily cleaned at any time**
**Air spaces pass through and over top of frame**
**Keeps frame cool and it cannot warp**
**Burns cheapest fuel with good results**
**Level at all times when locked**
**No bars stick up in fire and burn off**
**Will not break boiler front when shaking**
**It is alone in its class**

We further guarantee that these Bars are warranted not to be an infringement on any prior patents. We stand behind our customers and guarantee them in the unmolested use of our own invention.

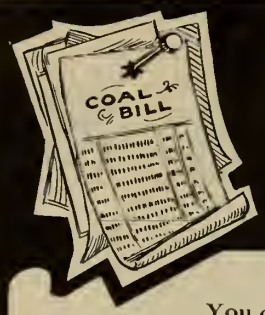
***Boiler Setting and Repairs a Specialty***
***Boiler Tubes, Either Welded or New, at Lowest Price***

*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

## The DIAMOND GRATE BAR Company

**Head Office and Factory, Berlin, Ont.**

**Branch Office, 119 St. James' Chambers, Toronto.** **Tel. M 1342**




# BOILER SCALE IS A LUXURY!

You can't afford to have Boiler Scale because it greatly increases your coal bills, gives extra work to your fireman, decreases the efficiency of your boiler and finally ruins it altogether.

**Red Star Boiler Compound** is in powder form, highly concentrated. It comes in 5-lb. bags, packed in barrels containing from 200 to 400 lbs. A five-pound bag dissolved in two gallons of water (preferably hot) makes a little more than twenty-one pounds of liquid compound that is superior to anything in preventing scale formation. It is non-corrosive and will not rust, pit or otherwise injure a boiler.

**A Feeder Free** Wherever our Red Star Compound is used we will loan one of our Perfection Automatic Back Pressure Boiler Compound Feeders ABSOLUTELY FREE.

WRITE FOR OUR ILLUSTRATED BOOKLET

## HYGIENIC LABORATORIES, Limited

11 COLBORNE ST., TORONTO, CANADA

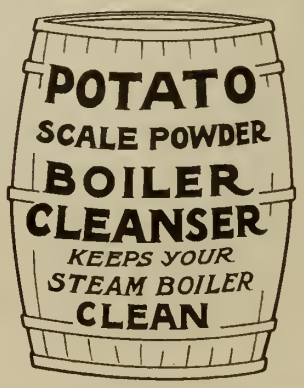
# RED STAR COMPOUND KILLS SCALE!

THE POWER HOUSE R

# Potato Scale Powder Boiler Cleanser

## THE FUEL SAVER

NO EFFECT ON THE BOILER PIPES SHELL or CONNECTIONS




KEEPS YOUR BOILERS FROM FOAMING

**Guaranteed to give satisfaction**

We can furnish you with hundreds of testimonials from some of the best plants in the world.

*Sole Agent for America:*

## C. C. SNOWDON

Mail us a sample of your water and we will prove to you that we keep your boiler clean without doing it any damage, besides save you a lot of money in fuel.

## WHOLESALE OIL MERCHANT, CALGARY, ALTA.

P.O. BOX 1384 PHONE 417

BRANCH STORAGE AT NEW YORK

Address all Correspondence to CALGARY.

BRANCH STORAGE AT MONTREAL

# BOILER INSURANCE

## A Mighty Good Thing to Have ?

**Yes, by all means, and a barrel of "SKALEOFF" for that boiler is mighty good insurance against scale formation.**

¶ There are many methods of removing scale from boilers and many a man, after spending good hard cash (and plenty of it) for "Purifying Systems," "Filters," "Tube Cleaners," etc., is still scratching his head and wondering "What Next?" While he waits until "opening up" in order to get his cleaners working, he burns enough fuel (that is *wasted* in heating through the forming scale) to buy three or four cleaners.

¶ Now, is this good business? *We* don't think so and neither do *you*.

¶ When you use the "SKALEOFF" vegetable feed-water treatment you get close to Nature. "SKALEOFF" is natural and absolutely harmless to boilers and is prescribed by expert chemists and prepared by competent workmen in an up-to-date plant. Nothing but the purest ingredients are used.

¶ NO QUACK MEDICINE with the same dose for any old boiler any old place. *We deal with each plant individually, on a scientific basis and* WE GUARANTEE RESULTS ! !

¶ If your feed water is bad and you spend time and money cleaning out your boiler more often than you think you should, let us know all about your trouble, and we will offer sympathy, advice and a cure.

¶ We positively guarantee to remove and prevent scale, prevent foaming and corrosion and will take care of the oils from your returns at the same time. We will preserve the boiler and packings and will not harm the various piston and valve rods.

**WE WILL GIVE YOU A LONGER RUN PER BOILER.**

## Users of "SKALEOFF"

After analyzing your own particular feed water we will send you a barrel of

"SKALEOFF"

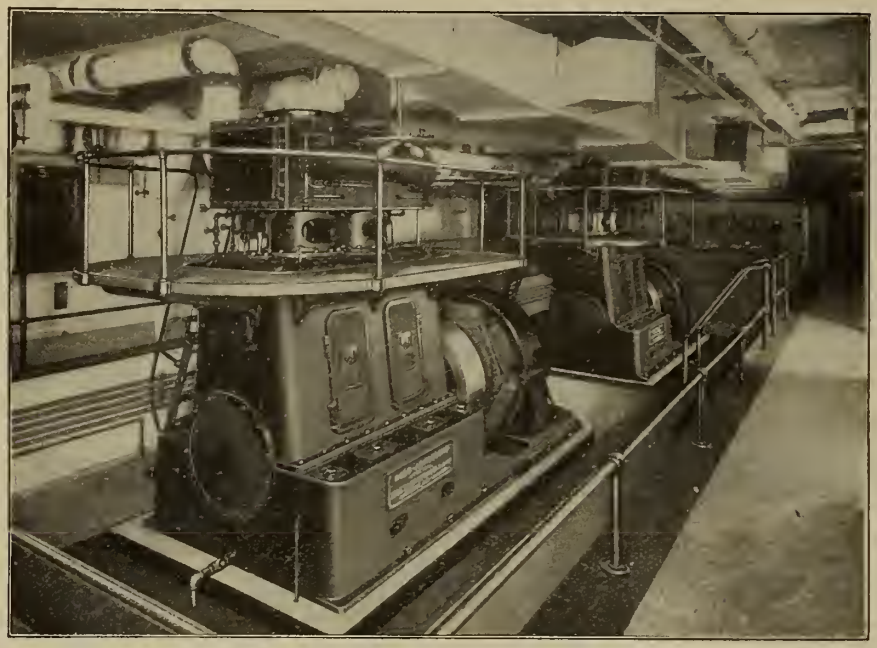
specially prepared to meet your requirements.

run absolutely no risk. Write us telling, as near as possible, the conditions to be met with in your plant, the approximate number of gallons per day's run and send us a gallon sample of your feed water (at our expense). We will analyze it FREE and quote you a price on keeping that boiler of yours *clean the year round* that will make you wonder why you did not hear of us before.

This at no expense to you. Give it a fair test and if it succeeds in cleaning your boilers talk business with us. If not you lose nothing by the trial. Isn't that a fair and square offer?

## The "SKALEOFF" Co.

Head Office: 97 Shannon Street, Montreal.



# HIGH SPEED VERTICAL ENGINES

of the English enclosed type with pressure oiling system, installed by us at the

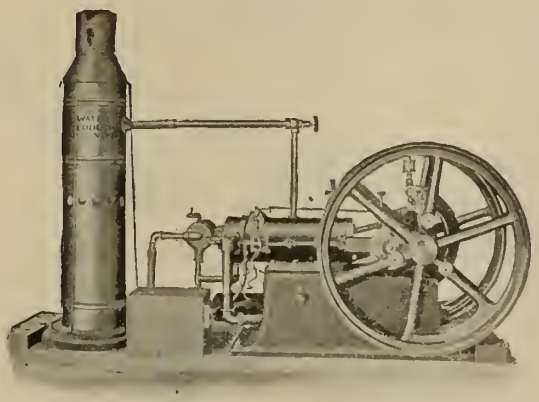
**TRADERS BANK,**
**TORONTO**

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES
709 Power Building, MONTREAL; Watson Jack, Manager.
Traders Bank Building, TORONTO; Wm. McKay, Manager.
Union Bank Building, WINNIPEG; W. F. Porter, Manager
Calgary Block, CALGARY; J. F. Porter, Manager.

# GAS and GASOLINE ENGINES

## 1½ to 25 H.P.



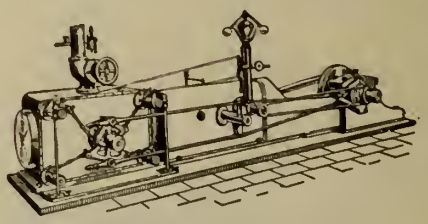
If interested it will pay you to write for our Catalogue

## Goold, Shapley & Muir Co.
Limited

BRANTFORD - CANADA

# ENGINES—

Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper



# BOILERS—

Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS
LONDON, - ONT.

# UNIONS and FLANGES

## THAT WILL NOT LEAK

Never require attention and may be used over and over again are the kind you get when buying Dart's.

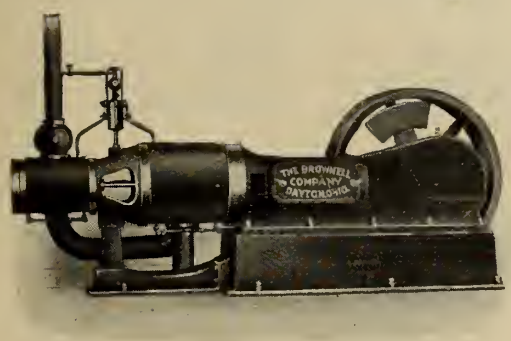
## WE GUARANTEE THEM

The kind with heavy iron ends
and all-bronze spherical joint.

It's worth your consideration. Name on every one.

# DART UNION CO., Limited

Office and Works: 93-97 Niagara St., Toronto




## The Brownell Company

Dayton, · Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

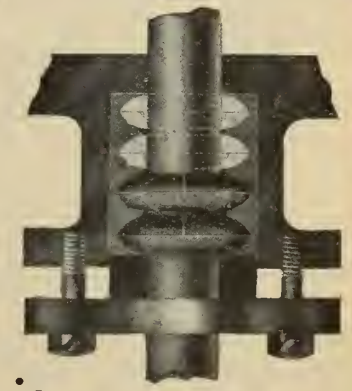
925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

## THE Packing That Stays Packed



is

## The Rhodes Improved Metallic Packing

For EVERY service of rod packing and ESPECIALLY ADAPTED FOR AMMONIA.

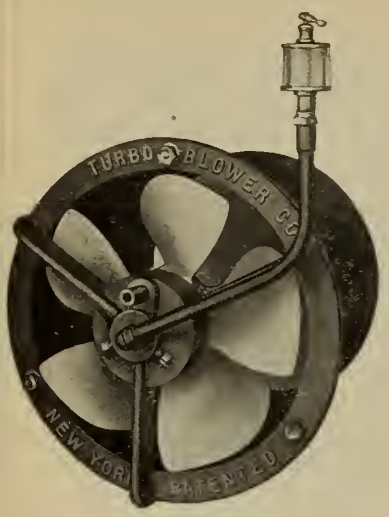
GUARANTEED!!

Write for Prices and list of Happy Users.

AGENTS WANTED

**The Rhodes Improved Metallic Pkg. Co.**

11 St. Nicholas St., Montreal Limited




THE
**TURBO-BLOWER**
is the latest and most improved device for
**MECHANICAL DRAFT**

It will effect a great saving by giving "MORE POWER FOR THE SAME MONEY OR THE SAME POWER FOR LESS MONEY," giving better results and prove invaluable in EVERY POWER PLANT. It is the SIMPLEST, BEST, EASIEST-RUNNING, UP-TO-DATE TURBINE BLOWER on the market. Its construction embodies the combined principles of a BLOWER and a STEAM JET and a SELF-CONTAINED MOTOR; the latter entirely enclosed and absolutely beyond reach of ashes, dirt or dust.

The TURBO-BLOWER is furnished in various sizes and at prices low enough to make its service necessary in every power plant. Write for further information and catalogue.

TURBO-BLOWER CO., 30 Church Street NEW YORK, N.Y.

**VENETIAN GRATES**
STEAM BLOWN

**Cheap Power**
WITH
**Cheap Steam**

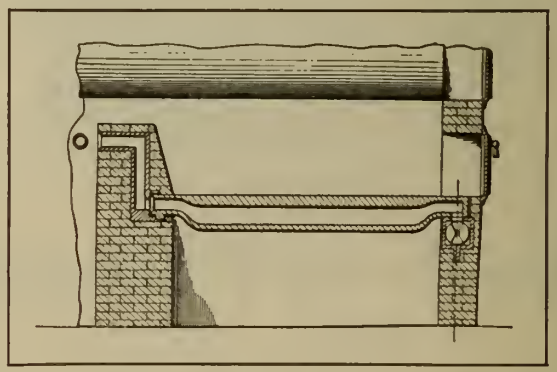
Your boilers fired with cheap grades of fuel, with a saving of 15% to 60% in your fuel bills.

SMOKELESS COMBUSTION

WRITE US FOR PRICES AND PARTICULARS

**The Canada Gas Power & Fuel Co.**
68 St. James St. West, Montreal

# Fleming Grate Bars



An examination of this cut will give some idea of the scientific principle upon which Fleming Grate Bars are constructed. The natural draft entering the **AIR COMBUSTION CHAMBER** causes a continuous passage of air through the grate bars, over the bridge wall and into the combustion chamber, where, now heated to a temperature of 600° F., it unites with the unused carbon, causing a further combustion and a consequent increase in heat units. The never-ceasing current of air, passing through the bars, keeps them comparatively cool, thus preventing the adherence of clinkers as well as insuring them a life which is practically perpetual. In addition to the economy in fuel consumption there will be a proportionate decrease in the labor of cleaning, in the expense of renewing grates—to say nothing of the decrease in smoke.

**It means** that with Fleming Grate Bars under your boiler you save from TEN to TWENTY DOLLARS on every hundred dollars worth of fuel you buy.
WRITE FOR BOOKLET.

**BUTTERWORTH FOUNDRY, LIMITED**
53 QUEEN STREET, - OTTAWA, - ONTARIO

# GUARANTEE

We will instal the Ideal Internal Steam Separator on 30 days' free trial, and if it does not do as we say, we will remove same without cost to you.

## Engineers and Manufacturers

Read this Letter

Toronto, Oct. 28th, 1908.

Mr. H. J. Allison,
170 Strachan Avenue, Toronto, Ont.

Dear Sir,

Replying to your letter of the 1st, in reference to the Ideal Internal Separators installed in the boilers at the Central Prison, Toronto, I beg to say it is not customary to give testimonials from this Department, but in this case exception will be made. Two years ago an electric light plant was installed in the Prison, and it was found necessary —owing to water being carried over to the engine—to cut off the steam supply from the Bonson Boiler; this boiler's steam outlet is taken from the front head and water was carried over in large quantities. After a special Internal Separator was made and installed, this boiler was again connected with the lighting plant and the results from same were satisfactory in every respect.

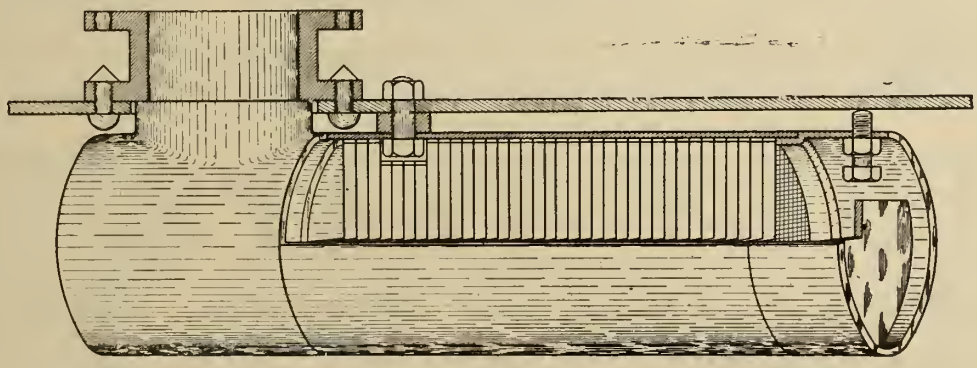
From information received from the operating engineer, and from my own observations, the trouble from water being carried over to engine is completely remedied.

Yours very truly,
D. M. MEDCALF,
Inspector of Boilers, etc.

The above letter is the only testimonial ever given by a Government Department to any firm or individual. It indisputably proves that the

# IDEAL INTERNAL STEAM SEPARATOR

is all that we claim it to be.



Showing Separator installed in Horizontal Return Tubular and Water-tube Boilers.

It supplies dry expansive steam at the boiler outlet by separating the saturated particles at the initial point.
It is an absolute safeguard against any accident due to water shock.
It is inside the boiler and needs no attention.
It saves fuel, oil, packing and repairs.

*Write us to-day for illustrated circular showing loss of heat due to moisture of steam at boiler outlet.*

# Ideal Steam Separator & Supply Co.

75 ADELAIDE STREET EAST, TORONTO

We also manufacture Potter Separators, Whaley Automatic Smoke Preventers, and Leonhardt Gauge Glass Protectors.

Selling Agents for Wm. W. Nugent & Co., Chicago, Lubricating Devices; Harris Smokeless Furnace Co., Nashville, Tenn.; Watson & McDaniel Co., Philadelphia, Steam Traps and other steam specialties.

WRITE FOR CATALOGUES

# MASON

Reducing Valves
Pump Pressure Regulators
Damper Regulators
Pump Speed Governors
Balanced Valves

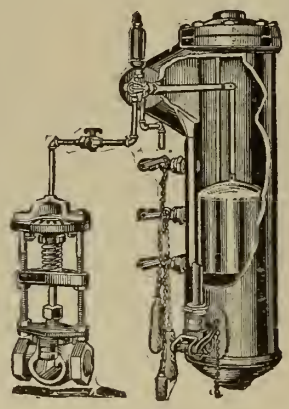
It is not what you pay for an article, but what the article pays you in return for its cost, that determines its value.

(Genuine)

# ASHTON

Pop Safety Valves
Pressure Gauges
Vacuum Gauges
Recording Gauges
"Ideal" Alarm Gauges

## Berry Boiler



## Feed Control

THE SIMPLEST AND BEST REGULATOR

WE ALSO SELL

## BUNDY STEAM TRAPS

THE BEST FOR ALL SERVICES.

If your dealer cannot supply you, write to us for catalogues and full particulars.

## Peiler & MacKenzie,

52 ST. JAMES STREET
MONTREAL

# "BUNDY TRAPS" SAVED 30%

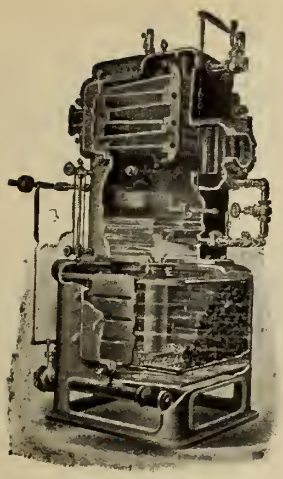
The Standard Shirt Co., Montreal, installed "BUNDY TRAPS" and now dry their linen in 19 minutes instead of 30 minutes. :: :: ::

# "WING BLOWERS" SAVED 25%

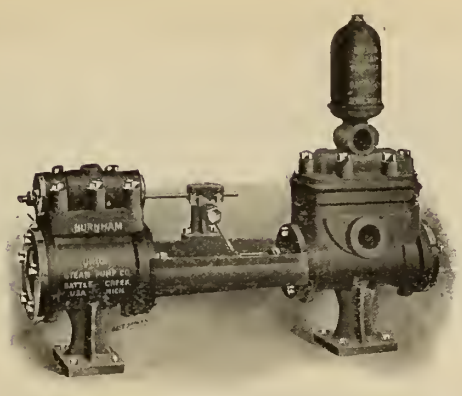
The Laing Packing & Provision Co., Montreal, installed "WING BLOWERS" and now burn coal costing $3.00 instead of $4.00 per ton.

## Russel & Gifford

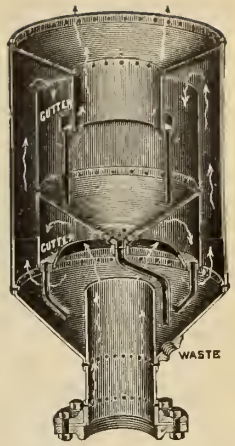
505 Power Building - - - - Montreal



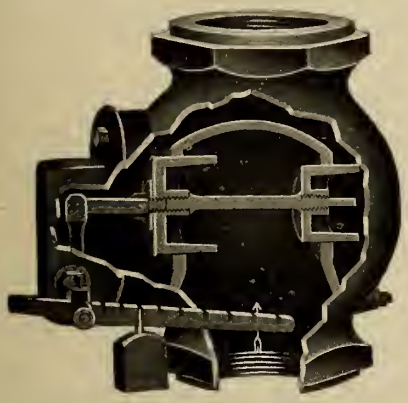
Webster Feed Water Hea'ers



The Burnham Double-Acting, Single Cylinder Pump




The "Cyclone" Exhaust Head



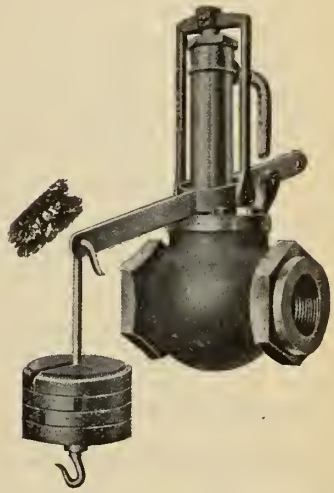
Noiseless Back Pressure Valve

# Darlings' Steam Specialties

## OUR GUARANTEE

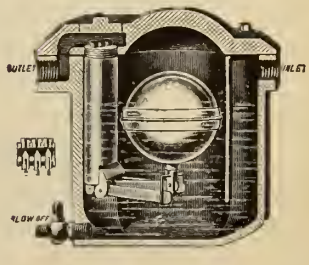
WE fully guarantee all goods of our make to be of the highest stand rd of quality, as regards material, con:truction and workmanship; and that each device, when properly installed, will satisfacto ily perform the service for which it is de:igned.

WRITE FOR SECTION 12F.



High Pressure Reducing Valve

Blow Off Tank



The Wright "Emergency" Steam Trap

The Webster Standard Horizontal Oil Separator—2"—16"

## Darling Brothers
LIMITED

HEAD OFFICE AND WORKS:

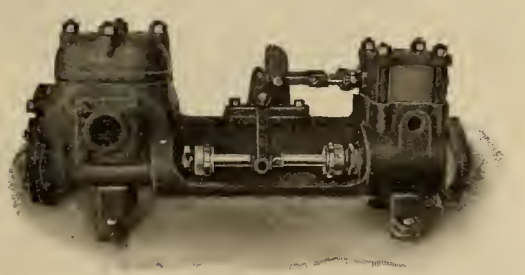
Montreal

Toronto Winnipeg

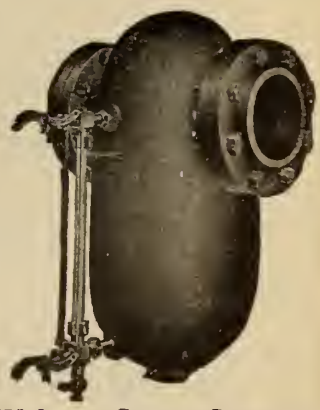
St. John, N.B.

F. Darling & Co.

Vancouver, B.C.



Advance Duplex Steam Pumps



Webster Steam Separator

# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

NEW YORK CITY BRANCH, 1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS TROY, N.Y.

# A POWER SAVER

**Is Harris Heavy Pressure Bearing Metal**

WHY?

It Eliminates Friction

Contains in Itself Great Lubrication

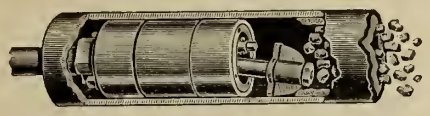
Surely the above will Save You Power.

WILL NOT Crack, Break Or Beat Out of Bearing

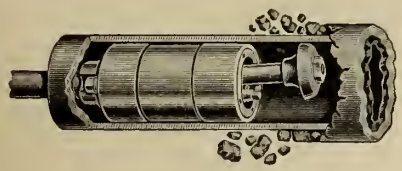
**Truly It is Perfection in Babbitt Metal**

Sold and Manufactured by

**The Canada Metal Co., Ltd., Toronto**



The Dean removing scale from the tube of a water tube boiler.



The Dean removing scale from the tube of a return tubular boiler.

## "FROM WATER TO STEAM"

tells how steam can be generated economically: it tells what boiler scale does; it tells the truth about compounds; and it tells about

# The Dean Boiler Tube Cleaner

Write us, giving name of your plant, the number of boilers there, and size of the tubes, and we'll send you a copy of this interesting booklet.

Ask about our free trial offer.

THE WM. B. PIERCE CO., - 330 Washington Street
BUFFALO, N.Y.

## PLOMO BELT DRESSING

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical--a spoonful will dress an 8 inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places Permits belts to be run slack without slipping--slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

*Write for Booklet and 25 lb. trial package.*

**The Plomo Specialty Mfg. Co.**
CLEVELAND, O.

If you have Joint Troubles,
If you have New Pipe Lines to erect,
If you have Superheat, Moisture, Oil, Gas, Water or Acid to care for,
In a word if you have Pipes (screwed or flanged),
Cylinders, Receivers, Economisers, Heaters, Radiators, etc. in use, you require

HAWKINS' IMPERISHABLE JOINTING CEMENT

Send for Booklet and Prices.

BAIN & MITCHELL, Y.M.C.A. Building, MONTREAL

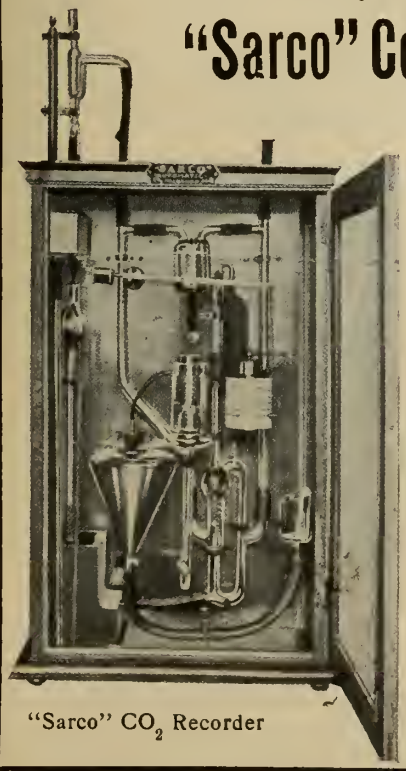
Sole Canadian Agents for

W. T. HAWKINS & CO., HUDDERSFIELD, ENG.

# Keep Tab on Your Fuel Combustion

*by using a*

## "Sarco" $Co_2$ Recorder



"Sarco" $CO_2$ Recorder

Tells at a glance, upon an exposed chart, the exact percentage of carbon dioxide ($CO_2$) in the flue gases of your boiler furnaces. The nearer you get to 20% $CO_2$ in these gases the nearer you are to complete combustion and the Recorder is made to keep you informed.

WANT PARTICULARS?

CANADIAN INSTRUMENT & TESTING CO.
MONTREAL

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA

# Power Equipment

## Our Engines, Boilers, Heaters, Pumps, Condensers, etc., are prominent in Canada's Largest Power Stations

BECAUSE THEY ALWAYS GIVE PERFECT SATISFACTION

Standard Type of Ontario Boiler, 13 feet long and under.

## WE BUILD FOR POWER HOUSES

**Wheelock Slow Speed Engines, Goldie Corliss Engines, Ideal High-speed Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Return Tubular, Water Tube, Horizontal Marine, Vertical and Portable Boilers, Heaters, Pumps and Condensers**

## The Goldie & McCulloch Co., Ltd.

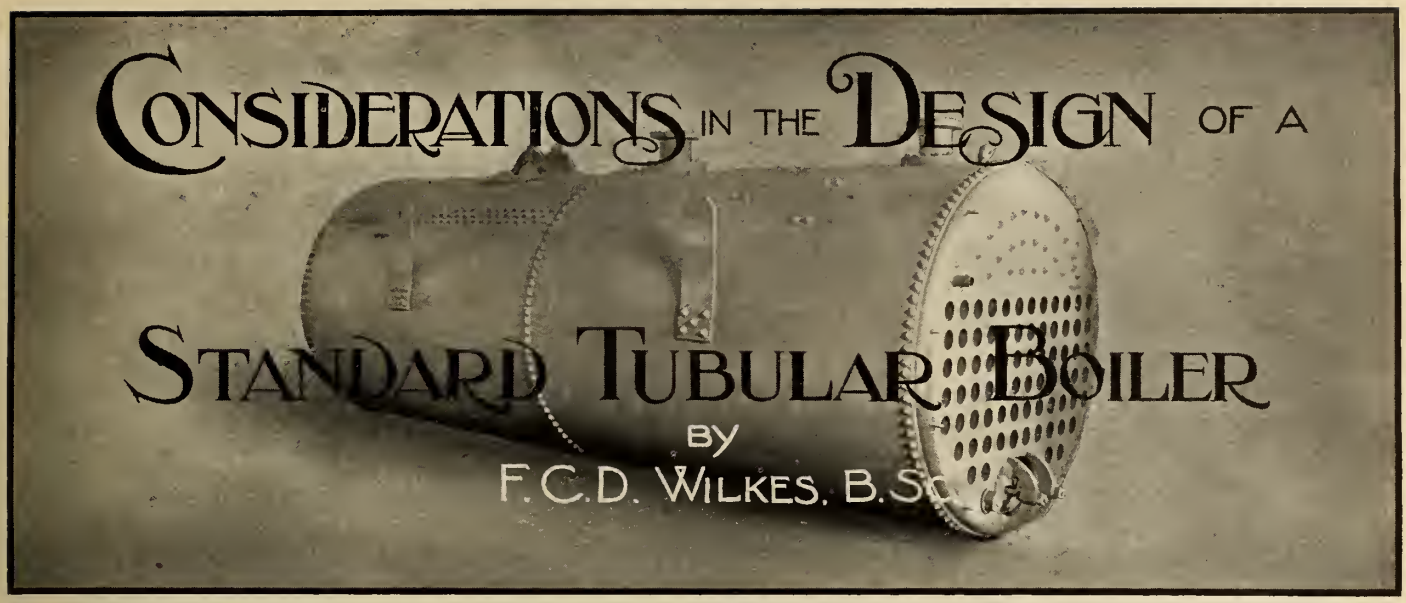
Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B.C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

# Considerations in the Design of a Standard Tubular Boiler



By F.C.D. Wilkes, B.Sc.

A knowledge of the physical peculiarities of the different materials used in the manufacture of boilers is exceedingly important to the designer or builder of boilers since it enables him to choose wisely those best suited to each of the various parts. The materials most universally used in the manufacture of boilers are wrought iron and steel.

### Properties of Wrought Iron.

At a temperature of between 1500 and 1600 degrees F., wrought iron softens, and if the surfaces of two pieces thus heated are placed together (a flux being applied to prevent oxides of the metal being formed) the two pieces may be united or welded by hammering. Good wrought iron may be easily forged or welded, but on account of its high melting point (about 3000 deg. F.) it is difficult to cast it into molds like cast iron or steel. It has a fibrous composition due to the process of manufacture. The successive rolling has a tendency to cause the fibres of the iron to run parallel to the direction in which the metal is being rolled. This fibrous structure is easily recognized if a piece be broken by a pulling or tensile force.

If the metal is subjected to repeated shocks or loads, that exceed its elastic limit, the structure changes and becomes more crystalline in form.

Wrought iron cannot be hardened and tempered as can steel, but it may be case hardened by rubbing the surface, when at a red heat, with potassium cyanide and quenching in water Another way is packing the iron in powdered charcoal and heating for several hours, after which it is quenched in water. This process converts the wrought iron into steel to a slight depth below the surface. Wrought iron may contain as much carbon as mild steel, but is far more fibrous and less crystalline. This fact is due to the method of manufacture wherein the successive rollings have a tendency to cause the fibres of the iron to run parallel to the direction in which the metal is rolled. It is graded, according to the amount of working each class receives, under the headings refined, double refined, etc. The ultimate result, of course, depends upon the grade of stock used in its manufacture.

### Defects in Wrought Iron.

Wrought iron produced from poor ore and having an excess of phosphorus is termed "cold short." This grade is very brittle when cold and is liable to crack when bent, but can be satisfactorily bent if heated to a high temperature. If the iron contains excess sulphur it is said to be "hot short" or brittle and liable to crack when hot. This, then, is useless for welding, but is tough when cold and is used for making tin plates.

### Steel.

It would be a difficult matter to give a concise definition of steel that will include all the grades produced and at the same time exclude cast iron and wrought iron. Steel is essentially an alloy of iron and small per centages of carbon, the latter being present in greater quantities than in wrought iron and in smaller quantities than in cast iron. Small percentages of other elements are after added in order to give special properties to the product. Steel is made by one or other of the following processes: open hearth, Bessemer and crucible.

Open hearth steel is made by melting a charge of pig iron with wrought iron or steel scrap, or by melting pig iron and iron ore in an oxidizing flame to remove the excess carbon. The furnace is called open hearth because it is open at both ends. In this process the excess carbon is burned out until only the desired per centage remains, at which point the process is stopped. Gaseous fuel is used and (excepting in the case of natural gas) both gas and air are heated in what are called regenerative furnaces. This grade of steel is used for the best grades of steel plate, forgings, etc.

### Bessemer Steel.

The Bessemer process consists of removing the carbon from a charge of pig-iron by forcing a blast of air through the metal while in a molten state. The oxygen of the air unites with and carries off the carbon. Then a quantity of pig iron, which is free from impurities and contains a known amount of carbon, is added to the charge in sufficient quantities to give the desired per centage of carbon to the mixture. This operation is called recarbonizing. The molten metal is then poured into ingot molds and formed into blocks of metal called ingots. Bessemer steel is greatly used for rails, nails, structural shapes, etc., and produces as satisfactory results, in many cases, as the high grade and more expensive open-hearth steel.

### Crucible Steel.

The crucible process of making steel is the oldest and most simple of the processes. The stock, which is melted in a crucible, consists mainly of wrought iron and steel scrap with sufficient charcoal to give the correct per centage of carbon. As practically no sulphur or phosphorus is removed from the charge in this process the stock must be free from these impurities in the first place.

We are indebted to the Waterous Engine Works Co., Brantford, for the photographs used to illustrate this article.—Editor.

The cost of making steel by the crucible process is higher than by the open hearth or Bessemer process, and for this reason crucible steel is used mainly in the manufacture of tools and in those cases where its high cost is compensated for by the better quality of the product.

### Stress.

Every body is composed of molecules, which are held together by cohesion. To deform or alter the body in any way this cohensive force must be overcome to a greater or less degree. These deformations are called strains, and the forces by which they are produced are called stresses. The application of the external stresses is opposed by the production of internal stresses and the extent to which these internal stresses are capable of resisting the external ones constitutes the strength of the material.

When a piece of material is subjected to a stress of such a magnitude that deformation remains permantly after the stress is removed, the structure of the material has been more or less broken down or, in other words, the elastic limit has been passed.

It is clear then that no material should be subjected to stresses in every day practice that will result in the breakdown of its molecular structure, since no further resistance can then be expected of it. The important thing to know then, is not the force that will produce rupture, but the magnitude of the force at which the breakdown begins so that the load applied will be within this limit. In other words, it is not the breaking load which is required, but the permissible fibre stress to which the material may be subjected.

The external forces which cause strains in a material may produce any of the following: (and in most instances a combination of two or more) tension, compression, bending, torsion or twisting, and shearing or cutting.

The stresses that appear in boiler construction are tension and shear mainly, but when internal furnaces are used these are subjected to a crushing or compression stress.

### Tension.

This stress is caused by the pressure in the boiler bending to tear the plate and is taken into consideration in designing the seams of the boiler and the stays.

### Shearing.

In boiler work shearing involves the rivets more than any other part. These can be in, what is called single shear, or double shear, and in some design of joints part of the rivets are subjected to single and some to double shear.

Single shear means that the body of the rivet is being cut at one place only, while in double shear the rivet is being cut at two points (see fig. 1 and 2.)

The shearing strength of a rivet in double shear is not, however, twice that of one in single shear, but only about 1.9. To be on the safe side this value is generally taken at 1.75.

### Factor of Safety.

It is evident that no structure should be submitted to strains that will deform the material involved beyond its elastic limit. In designing, therefore, a "factor of safety" is used to insure the sizes and weights of the materials being well within the elastic limit, or in other words, well within the limits of safety under ordinary working conditions.

The factor of safety is more or less arbitrary, but is usually between 4 and 6. The use of a set factor of safety has this disadvantage; if it is large enough to allow for cheap or careless workmanship it would be unfair to use the same

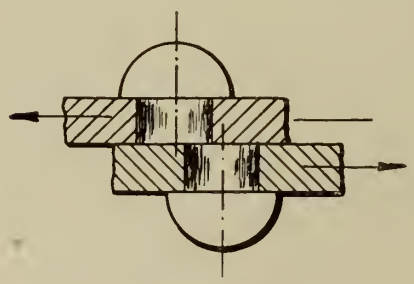


Fig. 1.—Rivet in Single Shear.

factor for higher grade work. The British Board of Trade calls for a factor of 4.5 "for a boiler of moderate length and of the best construction and workmanship." The United States statutes have rather an indefinite factor because the strength of the joint is not considered, except by the broad distinction between single and double riveting. The Steam Boiler Inspection Act, 1901, for British Columbia, defines the limits of the factor of safety very clearly. This Act says that when cylindrical shells of boilers are made of the best material (either iron or steel), with all holes drilled in place, the plates afterwards taken apart and the burrs removed, and all longitudinal seams fitted with double butt-straps, each at least five-eighths the thickness of the plates they cover, the seams being double riveted with rivets having an allowance of not more than 75 per cent. over single shear and having the circumferential seams constructed so that the percentage is at least one-half that of the longitudinal seams, and provided that the boiler has been open for inspection to the government inspector at all times during the whole period of construction, then 4 may be used as a factor of safety. But when the above conditions have not been complied with, the conditions in the following scale must be added to the factor 4, according to the circumstances of each case:—

A=.1— To be added when all holes are fair and good in longitudinal seams, but drilled out of place after bending.

B=.2— To be added when all holes are fair and good in longitudinal seams, but drilled before bending.

C=.2— To be added when all holes are fair and good in longitudinal seams, but punched after bending.

D=.3— To be added when all holes are fair and good in longitudinal seams, but punched before bending.

*E=.7— To be added when all holes are not fair and good in longitudinal seams.

F=.07—To be added if the holes are all fair and good in the circumferential seams, but drilled out of place after bending.

G=.1—To be added if the holes are all fair and good in the circumferential seams, but drilled before bending.

H=.1—To be added if the holes are all fair and good in the circumferential seams, but punched after bending.

I=.15—To be added if the holes are all fair and good in the circumferential seams, but punched before bending.

*J=.15—To be added if the holes are not fair and good in the circumferential seams.

K=.2— To be added if double butt-straps are not fitted to the longitudinal seams, and said seams are lap and double riveted.

L=.07—To be added if double butt-straps are not fitted to the longitudinal seams and said seams are lap and treble riveted.

M=.3—To be added if only single butt-straps are fitted to the longitudinal seams, and said seams are double riveted.

N=.15—To be added if only single butt-straps are fitted to the longitudinal seams and said seams are treble riveted.

O=1.0—To be added when any description of joint in the longitudinal seam is single riveted.

P=.2— To be added if all holes are punched small and reamed afterwards, or drilled out in place.

Q=.4—To be added if the longitudinal seams are not properly crossed.

*R=.4— To be added when material or workmanship is in any way doubtful, and the inspector is not satisfied that it is of best quality.

S=1.0—To be added if the boiler has not been opened for inspection during the whole period of construction.

When marked with (*) the factor may be increased still further if the workmanship or material is such as in the inspector's judgment renders such increase necessary.

### Strength of Boilers.

It might be interesting to note, before going further into the design proper of our boiler, that a thin cylindrical shell is twice as liable to burst laterally than it is to burst endwise, or in other words that it is twice as strong endwise as it is sideways or laterally.

In a boiler subjected to an internal pressure of (P) we may naturally assume that the tensile stress (f) is the same throughout the thickness of the metal; so that if (a) is the area of the metal at any section (axf) is the resistance of the metal to the bursting of the boiler at that section. If (A) is the whole area of the section, the force tending to cause the boiler to burst is (Axp) then, according to the law of strength

$$a \times f = A \times p$$

Thus in a spherical or ball-shaped thin boiler of diameter (d) and thickness of plate (t), the area (A), of a plane diametrical section, is

$$3.1416 \times \frac{d^2}{4}$$

(rule for area of a circle) and (a), area of metal, is $3.1416 \times d \times t$ (circumference multiplied by thinckness) and therefore our law of strength gives us:

$$3.1416 x d x t x f = 3.1416 x \frac{d^2}{4} x p$$

Cancelling and transferring we have

$$p = \frac{4 \times t \times f}{d}$$

Now taking a tube such as a boiler, and considering a section at right angles to the axis, we get the same formula. Considering a section parallel to the axis and assuming the boiler so long that the strength of the ends may be neglected, then if (l) is the length, (A) is $l \times d$ and (a) is $2 \times l \times t$ then

$$2 x l x t x f = l x d x p$$

Cancelling and transferring

$$p = \frac{2 \times t \times f}{d}$$

This shows there is twice the tendency to burst laterally as endwise and by studying in the same way the tendency to burst at any other section we find that the last formula:

$$p = \frac{2 \times t \times f}{d}$$

gives the least bursting pressure, and so the calculations for the strength of boilers take into consideration only the lateral strains.

### Boiler Horse Power.

We will assume that the boiler to be designed is of 125 rated boiler horse power. This leads us to consider just what meaning the term "horse-power" has in this case. Usually the term is used to define the amount of work done in a certain definite period of time by any source of energy, and is expressed

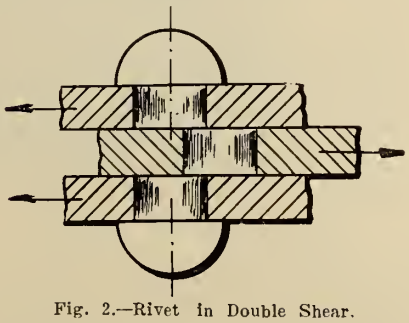


Fig. 2.—Rivet in Double Shear.

in foot pounds per minute (33,000 foot-pounds per minute=one horse-power) as in the case of a steam engine or water wheel. However, in the case of a boiler where the work done consitutes the conversion of water into steam and cannot be expresed in foot-pounds, the value given to the term horse-power is the evaporation of 34½ pounds of water per hour "from and at 212 deg.," or the evaporation of feed water at 212 deg. F. into steam at 212 deg. F.

The "rated horse power" of a boiler is more or less arbitrary and consists of a measure by which it can be sold or advertised. Unfortunately no definite, single value has been given to this measure, which varies considerably with local custom or the individual opinions of boiler makers and designers. This being the case, it is always advisable that tenders should specify in which way the rated horse power is to be determined and what value it is to have.

It is a general custom to design a return tubular boiler to have about 12 square feet of heating surface per rated horse-power and not less than one-third square foot of grate surface per horse power. We will take for our problem a boiler having a rated horse power of 125, and to work under a pressure of 125 pounds per square inch, steam pressure. According to the above assumptions of areas we will have a grate area of not less than 42 square feet and a heating surface of not less than 1500 square feet.

### Tubes.

When hard coal is to be used the tubes should have a diameter of one inch to every five feet and one inch to every four feet if soft coal is to be burned. We will assume the boiler is to be not more than 16 feet long, therefore, if we use soft coal our tubes will be 4 inches in diameter. The number of tubes is dependent on the grate surface to a more or less degree and the total sectional area of the tubes should be about one-sixth to one-seventh that of the grate area; we will take one-seventh. The sectional area of a 4-inch tube is 10.9 square inches, so we should have at least

$$\frac{42 \times 144}{7 \times 10.09 =} = 79.2$$

or say 80 tubes. This number might vary one or two tubes on the lay out and make no material difference in the qualities of the boiler.

### Steam Space.

In boilers of this type it is good practice to allow from .8 to 1 cubic foot of steam space, per horse power, so that our steam space would be from 100 to 125 cubic feet. We will use 115 as a mean value and then figure from this the trial diameter of our boiler. The term "trial diameter" is used because, on proportioning the other parts of the boiler it may be necessary to change it. A usual proportion in return-tubular boilers is one-third of the contents of the boiler steam-space and two-thirds water-space. Therefore, to find the volume of the boiler shell we must add to the contents the volume of the tubes.

The external area of 4-inch tubes is 12.56, the volume occupied then is

$$\frac{12.56 \times 80 \times 16}{144} = 111.5$$

say 112.

The water space being twice the steam space gives 230 cubic feet water space.

Then the area of a section of our boiler will be

$$\frac{(112+115+236)}{16} = 28.5$$

square feet. This area is the area of a 72-inch circle, so the outside diameter of the smallest course in our boiler will be 72 inches.

Now we can check up our heating surface and see how nearly it figures out to that assumed. In computing the heating surface of a return-tubular

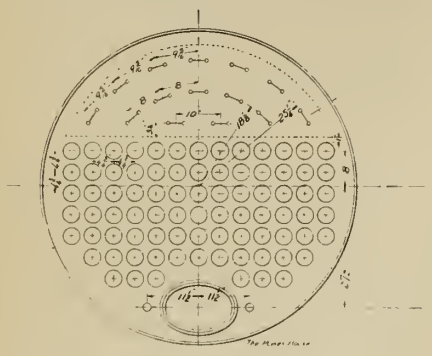


Fig. 3.—Layout of Head.

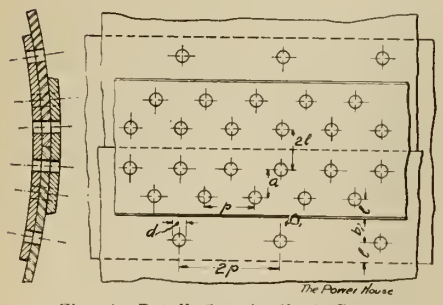


Fig. 4.—Detail Longitudinal Seam.

boiler we again encounter more or less arbitrary rules. A rule that is widely used and which we can employ with assurance of very approximate results is the following

$$\frac{2}{3}A+a+\frac{2}{3}ah-sa$$

where

A=area of shell

a=total outside area of tubes.

ah=area of both heads

sa=total sectional area of tubes

Supplementing our values we have for the shell

$$\frac{226}{12}\times\frac{2}{3}\times 16=201 \text{ square feet,}$$

square feet for the tubes

$80\times 1.04\times 16=1331$ square feet,

square feet for the heads

$$\frac{2\times 4071}{144}-\left(\frac{12.56}{144}\times 60\right)=42 \text{ sq. ft.}$$

or a total of 1573 square feet.

**Figuring Longitudinal Seams.**

The strength of a rivet joint depends principally upon the strength and ductility of the plates, the proportions of the pitch and diameter of the rivets to the thickness of the plates, the manner of perforating the plates for the rivets, the shearing strength of the rivets, per centage of plate between the rivet holes, the form of the joint and upon the stress being borne evenly by all the rivets in the joint.

Our boiler is to have an allowable working pressure of 150 pounds per square inch, and is to be 72 inches in diameter. The allowable working pressure depends on the efficiency of the joint, the diameter of the boiler and the thickness and strength of the plates. We will use steel having a tensile strength of 60,000 pounds, and assume for trial purposes a thickness of plate say seven-sixteenths. Our factor of safety, from the laws above quoted, with all holes punched small and afterwards reamed out in place, will be 4+(P=.2) or 4.2 our steam being a double butt strap joint.

We now find what the efficiency of the joint must be so that 150 pounds pressure may be used. This is done by means of the following formula:

$$\%=\frac{D\times F\times B}{ts\times 2t}\times 100$$

where

D=diameter of boiler in inches

F=factor of safety

B=boiler pressure

ts=tensile strength of plate

T=thickness of plate in inches

Substituting our values we have

$$\frac{72\times 4.2\times 150\times 100}{60000\times 2\times .4375}=86.4\%$$

Now let us see if we can, with plates 7-16 inch thick, get a joint whose least percentage will not be less than 86.4.

Let us assume we have decided to make our joint of the form shown in Fig. 4, which is a style of joint obtaining a very high efficiency. This is a treble riveted, double butt strap joint with the outer row of rivets twice the pitch of the inner rows and not passing through the outside strap. Every alternate rivet is omitted in the outer row, which gives a much higher percentage for the plate. This is readily understood when one considers that the plate percentage, if these were not omitted would be

$$\frac{p-d}{p}$$

where (p) and (d) are the pitch and diameter of the rivet holes, whereas with the omission the percentage is

$$\frac{2p-d}{2p}$$

The first thing to be determined is the maximum pitch allowable according to the rules under which the boiler is to be built. This rule is

$$(C\times T)+1-\frac{5}{8}=pm$$

where

T=thickness of the plate in inches

pm=maximum pitch of rivets

C=constant applicable from the following table.

| Number Rivets in one Pitch | C for Lap Joints | C for Double Butt Strap Joints. |
|---|---|---|
| 1 | 1.31 | 1.75 |
| 2 | 2.62 | 3.5 |
| 3 | 3.47 | 4.63 |
| 4 | 4.14 | 5.25 |
| 5 | —— | 6.00 |

Substituting our values and considering the inner rows of rivets (Fig. 4) we have

$$(3.5\times .4375)+1-\frac{5}{8}=3.156$$

or say 3⅛ inches, then 2p will be 6¼ inches.

In the foregoing paragraph is mentioned the "least percentage." This is explained by the fact that the joint may fail in one of five ways.

(1) By tearing of the plate at the outer row of rivets.

(2) By shearing the rivets in all three rows, two rows in double and one in single shear.

Fig. 5.—Evolution of Pressed Steel Stay.

(3) By tearing the plate at the middle rows and shearing the rivets in the outer row.

(4) By the crushing of the plate in front of the inner row of rivets and shearing the outer.

(5) By crushing in front of all the rivets. These last two cases are very improbable, as the stress on the bear-

ing surface will seldom be so much as one-third of the ultimate strength, therefor they are not usually figured out.

The percentage strength of the plate at the outer row of rivets is

$$\frac{2p-d}{2p}\times 100 = \%$$

Substituting:

$$\frac{6.25-.8125}{6.25}\times 100 = 87\%$$

The size of the rivets has been taken as $\frac{3}{4}$ inch diameter, which makes d 13-16 inch.

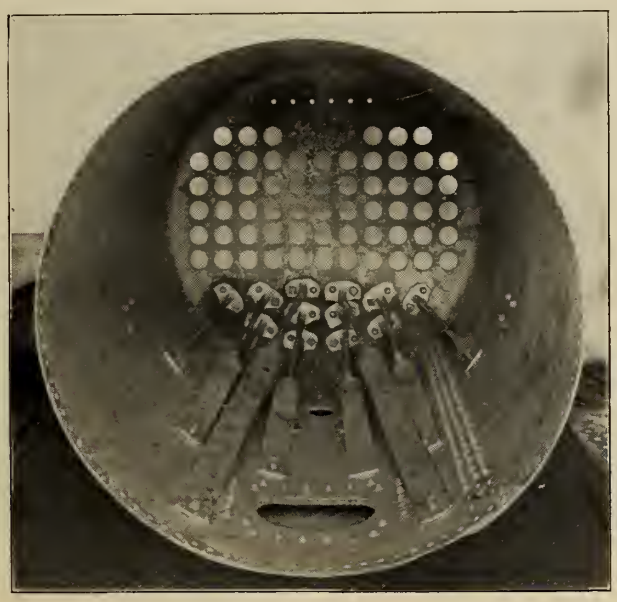


Fig. 6.—Rear End of Boiler Showing Diagonal Stays.

In case (2) there are two steps, the percentage of the inner and outer rows are figured separately and their sum is the percentage of the rivet section. These percentages are found by the formula:

$$\frac{AxNx23xCxF}{112xpxT}\times 100 = \%$$

where

A=area of one driven rivet in inches
N=number of rivets in one pitch
C=1 for lap joints and 1.75 for double butt strap joints.
F=factor of safety
P=pitch in inches
T=thickness of shell in inches.

Substituting we have for the inner rows:

$$\frac{.5184x2x23x1.75x4.2}{112x3.125x.4375}\times 100 = 114\%$$

for the outer row

$$\frac{.5184x1x23x1x4.2}{112x6.25x.4375}\times 100 = 16\%$$

giving a total of 130%.

In case (3) is considered the combined percentage of the plate taken at the middle row and that of the outer row of rivets.

Percentage for the plate

$$\frac{3.125-.8125}{3.125}\times 100 = 74\%$$

The rivet percentage in the outer row has already been found to be 16%, so the combined percentage would be 90%, and the three percentages all being higher than the percentage required for 150 pounds pressure (i.e. 86.4%) our assumed thickness of 7-16 inch for the shell is shown to be heavy enough. The butt straps have to be "at least five-eights the thickness of the plates they cover," according to strength, but for caulking reasons they should not be less than $\frac{3}{8}$ inch thick. Thinner butt straps are liable to spring when being caulked and in that case cannot be made tight.

The distance of the rivets from the outside of the plate should never be less than $1\frac{1}{2}$ times the diameter of rivet plus $\frac{1}{8}$ inch. The distance (b), Fig. 4, depends upon the size of the plunger of the riveting hammer or bull machine, and should be large enough to give sufficient clearance from the butt strap. The distance (a) is not a very important consideration as it has no effect on the efficiency of the joint, but it should not be too great because of the difficulty in keeping the seam tight. If it is too small the rivet sets or dies are apt to cut the next rivet when driving.

### Circumferential Seams.

This is very simply worked out. The pressure on the heads is

$$\frac{150\times 3.1416\times 72\times 72}{4} = 610{,}727 \text{ pounds.}$$

Suppose the heads are riveted to the shell with a single row of $\frac{7}{8}$ inch rivets, which are 15-16 inches in diameter when driven. The area of the driven rivet is .6902 square inch. Taking the shearing strength at 42,000 pounds per square inch, one rivet is good for 28,988 pounds The number of rivets needed will therefore be 610,727÷28 988=21.06 or 22. The circumference being 226.19 inches, gives a pitch of 226.19÷22=10.3 inches, which is, of course, out of all proportion. A $2\frac{3}{8}$-inch pitch is about right for this seam, which makes the rivet area more than four times as great. The next question is, will this pitch give a large enough plate section.

$$2\frac{3}{8} - \frac{15}{16} = 1\frac{7}{16}$$

inches net length of plate between rivets

$$1\frac{7}{16}\times\frac{7}{16} = .6289$$

square inch area of net section between rivets.

226.19÷$2\frac{3}{8}$=95 spaces

95×.6289×60,000=3,584,730 pounds

total strength of net section of plate

Total strength of rivets

95×28,988=2,753,860 pounds

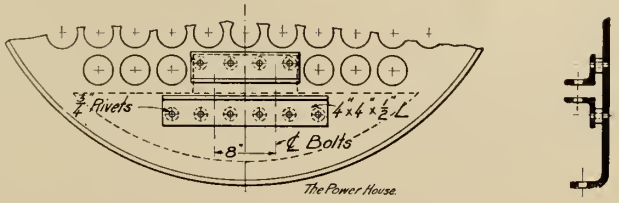



Fig. 7.—Staying Under Back Head.

Total pressure on heads 610,727 pounds, therefore the factors of safety are

$$\frac{3{,}584{,}730}{610{,}727} = 5.8$$

for plate and

$$\frac{2\,753{,}860}{610{,}727} = 4.5$$

for rivets.

Before laying out the tube sheets the normal water level should be deter-

mined because that will give a more or less arbitrary position to start from in laying out the tubes, on account of the fact that there should be at least five inches of water over the tubes with the water at normal level.

The production of dry steam is greatly helped by ample water space. When this is limited, it prevents quiet evolvement of the steam and the bubbles escape violently from the surface of the water. This produces an unsteady water level and the surface of the water is kept in a constant state of commotion, which results in much water being carried into the steam pipe by being suspended in the steam in fine drops.

Since the boiler is cylindical, the area of the head of the boiler exposed to steam will bear the same ratio to the area exposed to water as the steam space to the water space. This has been determined as one to two, so the area of the head above the water level must be one-third of the total area of the head less the total cross sectional area of the tubes.

The area of the head is 4071 square inches; the area of 80-4 inch tubes is $80 \times 12.56 = 1004$ square inches.

The area of steam exposed plate is

$$\frac{4071 - 1004}{3} = 1022$$

square inches.

The height of a segment of a 72-inch circle having an area of 1022 square inches may be found from a table of segmental areas and is 21 inches. Therefore the height of water level above

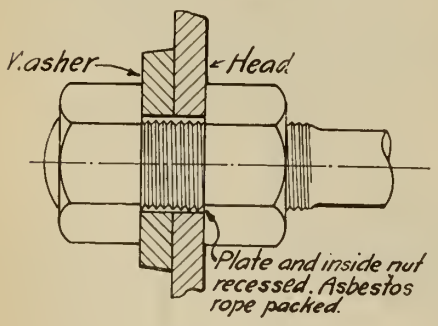



Fig. 8.—Through Stay Fastening (Not Exposed to Heavy Fire.)

centre line is 36—21=15 inches and the top of the tubes will be 10 inches above the centre line.

### Laying Out Tube Sheet.

The tube sheets should not be less than 9-16 inch thick for boilers, 72 inches in diameter. The tube sheet used in laying out the tubes is the smallest of the two heads or in other words the one in the smallest course. This will be 72 inches in diameter less twice the thickness of the shell or 71⅛ inches.

The tubes should not be closer to the shell than three inches and the "bridge" or space between the tubes should never be less than three-fourths of an inch, preferably one inch. Some builders prefer to have the tubes straddle the centre line and have this centre space twice as wide, anyway, than elsewhere, as they claim this assists circulation of the water.

Although a manhole in the head of a boiler is not always specified, it is a very good feature as it allows of more perfect cleaning and more thorough inspection. Furthermore in case of repairs to the bottom of the shell the work can be done without removing the tubes, excepting in large repairs, when only a portion will have to be removed. The manhole is placed as low as possible for good work in flanging, and should not be less than 10x15 inches, the short diameter being vertical. The distance of the centre of the manhole, from the outside of the head, should be half the short diameter plus from 3½ to 4 inches. Before the flanged edges are planed a reinforcing ring, 1½x⅜ inch, steel or wrought iron, is shrunk on (see Fig. 3) and the whole planed to make a smooth jointing surface for the manhole cover.

Having located the manhole we can lay out our tubes, starting from the top row and keeping the top of this row 5 inches below our normal water line. This brings the centre line of our top row, 8 inches above the centre line of the boiler. In laying out the tubes it was found that to have tubes straddle the centre, would necessitate raising the water level or cutting down the number of tubes. This, as has been said, is more or less up to the builders.

Above the tubes is a segmental area of flat plate that requires bracing to withstand the pressure. This is stayed by different makers in different ways, either by gusset plates, diagonal braces, or direct or end to end stays. There are many different designs for each method of bracing, some of them are good, others indifferent and some bad.

Part of the area above the tubes is "self-supporting," that is, it does not depend upon the stays for its support.

Fig. 9.—Evolution of Pressed Steel Bracket.

The reason is that the top row of tubes is responsible for some of the plate above them, and the shell supports a certain amount of the area of the head, namely about 3 or 4 inches in from the flange. One authority gives the following formula to determine that portion which becomes stiff enough to carry the boiler pressure without depending upon the braces:

$$\frac{\frac{1}{2}\sqrt{125 \times (T41)^2}}{B} + R = D$$

D=distance in from shell that is self-supporting

R=radius of curvature of head flange

B=working pressure

T=thickness of plate in sixteenths of an inch.

Substituting

$$\frac{\frac{1}{2}\sqrt{125 \times 100}}{150} + 1\frac{1}{2} = 6 \text{ inches.}$$

This value is rather high and as it is rather a difficult figure to determine, it is better to allow no more than 4 inches. Some designers do not give the flange curvature credit for rigidity and figure the flange side as a row of stays.

The pressure allowable on flat plates may be found by the formula:

$$\frac{C\times(T+1)^2}{A} = B$$

where

A=area supported in square inches
T=thickness of plate in sixteenths of an inch
C=constant=125 for riveted stays
B=working pressure

substituting

$$\frac{125\times(9+1)^2}{150} = A = 83\ 1\text{-}3$$

square inches.

Diagonal braces made of steel without welding are the most preferable kind to use. These are allowed as high as 9,000 pounds per square inch of sectional area. They have a "plan" at one end which is riveted to the shell and a "foot" at the other end which is riveted to the head.

Fig. 5 shows one of these weldless steel stays in three stages. The blank in the centre is cut from the solid steel plate heated uniformly throughout and pressed, to the shape shown on the right, in an hydraulic press.

In laying out the braces, they are so placed as to support the segment with as near an equal tension on each brace as possible, but owing to the shape of the area to be supported it is quite impossible to arrange the braces so that each one will carry the same load. We will assume, however, that a brace carries the same on every side and as the flange is to be considered a row of braces, it will support the head for a distance, half way to the outside row of diagonal stays.

As the plate is good for 83 1-3 square inches, the maximum pitch will be a little over 9 inches. Now, the tubes may be assumed to support, at least, one inch above the top so the height of our segment will be 36—(8+2+1)=25 inches. If we take three rows of braces, this will divide 25 by 3½ spaces which gives us a pitch between the rows of 7.-143 inches. This figure we can take and give a little on if need be, when laying out the stays provided, of course, that the area 83 1-3 square inches is not over stepped.

In Fig. 3, it will be seen that we get seven braces in the outer row pitched 9 5-16 inches, five in the middle row pitched 8 inches and two in the lower row pitched 10 inches. The greatest pitch is 10×7⅛ inches, and this gives an area for the plate of 71¼ square inches, which is far below the allowable area.

The greatest working pressure then that will come on a stay is

71.25×150=10,687 pounds.

If the stay be allowed 9,000 pounds per square inch the net sectional area would have to be 10,687÷9000=1.187 square inches, providing the stay was subjected to a straight pull. This section, however, will have to be greater as the stay is not at right angles to the head. The forula for diagonal stays is

$$A = \frac{B\times A\times H}{S\times L}$$

where

A=area of the stay in square inches
B=working pressure
H=length of the stay measured from the rivet in the head to the first rivet in the palm, in inches
L=length of line drawn at right angles from the head to first rivet in palm of stay, in inches
S=working stress of stay per square inch of sectional area.

This shows that the flatter the stay lies the greater the allowable pressure. Take for instance the two lower stays in Fig. 3. Say L was 50 inches, then H would be the long side of a right angled triangle having one side 50 and the other side 21½ inches long. Now if the distance 21½ inches were shortened L would still be 50 inches, but H would be smaller and consequenlty "a" would also be less for the same boiler pressure, so it is well to have the distance L as great as is convenient to good workmanship.

Making the stays 1½ square inches area gives for the longest (Fig. 10)

$$\frac{A\times S\times L}{A\times H} = B$$

or

$$\frac{1.5\times 9000\times 50}{71.25\times 54.4} = 174$$

pounds, for the middle stays 178 pounds, and for the short ones 183 pounds. The rivets in the palm being in single shear the aggregate area of the driven rivets should be 20 per cent. greater than the sectional area of the stay.

The rivets are at 4-inch centres in the head end of stay, therefore the area allotted to each rivet will be 7.125 (dis. between the rows)

$$\left(\frac{9\ 5\text{-}16+2=6\ 656}{2}\right)=47.42$$

square inches.

Stress per rivet = 150×47.42 = 7113.

Tensile strength of ⅞ inch rivet = 50,-000×.6902 = 34,510.

Factor of safety for rivets = 34,510 ÷7113=4.8.

Fig. 6 shows the rear head of a boiler such as we are designing, showing rows of these weldless steel stays in place.

### End to End Stays.

These are always preferable to diagonal stays on account of their taking the strain as a direct tension. They are objected to because if too close they interfere with a man's entering the boiler for examination. If placed far enough apart to allow this the head must be reinforced and the stays made heavy to compensate for the decrease in numbers.

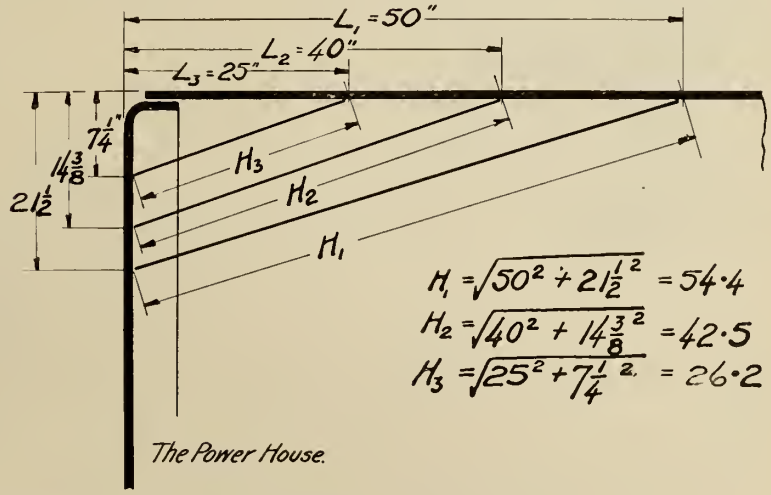



Fig. 10.—Diagram of Diagonal Stays.

In the back head is a space below the tubes that should be braced. This is usually braced by end to end stays. One method would be to fasten the stays at both ends as shown in Fig 8. This is objectionable because the nuts on the back end would be exposed to extreme heat and burn off in a short time. A better way is to use angle irons riveted to the shell, but with spacing washers at the rivets. The object of these washers is to allow water to circulate between the angle bar and the head and minimize the chance of the plate being burned out at this point.

Fig. 7 shows the end of the boiler under consideration stayed in this manner. The figuring for this is very simple, the area supported being that shown by the dotted lines. The rivets are in straight tension, the pins in double shear, and the stays in direct tension.

In Fig. 7 the rectangle is 13×4¾ inches area 61.75 square inches and the segment has an area of 256.25 square inches or a total of 318. The total

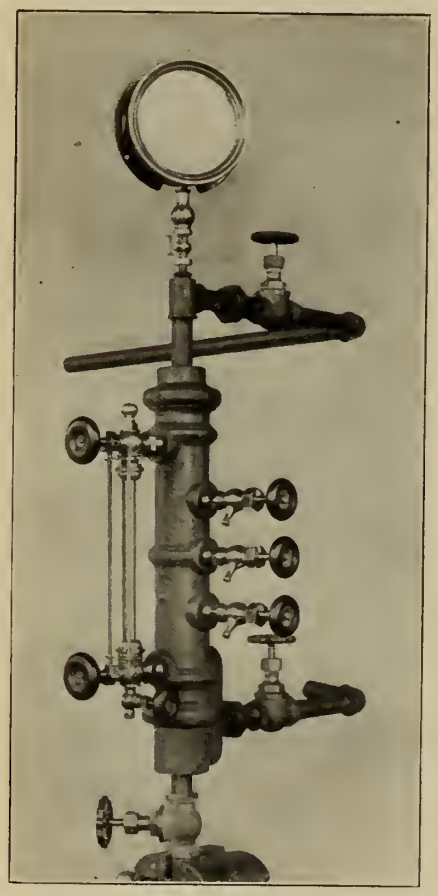


Fig. 11.—Standard Water Column and Connections.

pressure will be 318.×150=47,700 pounds. The strength of a ¾ inch driven rivet with area .5184 square inch and tensile strength per square inch of 50,000 pounds is .5184×50,000 = 25,920 pounds. The working strength with a factor of 5 would be

$$\frac{25{,}920}{5} = 5124 \text{ pounds.}$$

Then

$$\frac{47{,}700}{5124} = 9.2,$$

say 10, rivets will be needed.

As there are two stays the pressure on each will be 23,850 pounds. The bolts are in double shear and have a shearing strength of, say 40,000 pounds per square inch, therefore the area (with a factor of 5) will be

$$\frac{23{,}850}{1.75 \times 40{,}000} = 1.703$$

5

square inches, then the nearest diameter is 1½ inches, which has an area of 1.767 square inches. The stays have a welded eye for the bolts and account of the weld should only be allowed 6 000 pounds per square inch and therefore the area would be 3.974 square inches or 2¼ inches diameter. In the nut this should be 2½ inches diameter.

The manhole should be large enough to serve its purpose, but no larger because cutting the hole weakens the plate to quite a considerable extent. This weakness is compensated for by surrounding the hole with a reinforcing ring. The older practice was to have a cast-iron ring, which was hard to fit and unreliable on account of the question as to its homogeneous internal structure. The best way is to use a liner of the same material as the shell riveted in place.

The manhole is 10 x 15 inches with the major axis at right angles to the

Fig. 12.—Various Types of Stationary Grate Bars.

centre line of the boiler. The area of section cut out is 10×.4375=4.375 square inches, then if the liner is 9-16 inch thick the total width will be

$$\frac{4.375}{9\text{-}16} = 7.78$$

plus twice the rivet diameter or 1¾ inches =9.405, say 9½ inches. Half of this is on one side and half on the other side of the manhole.

The number of rivets is found by finding the strength of cut-out plate and making the shearing strength of the

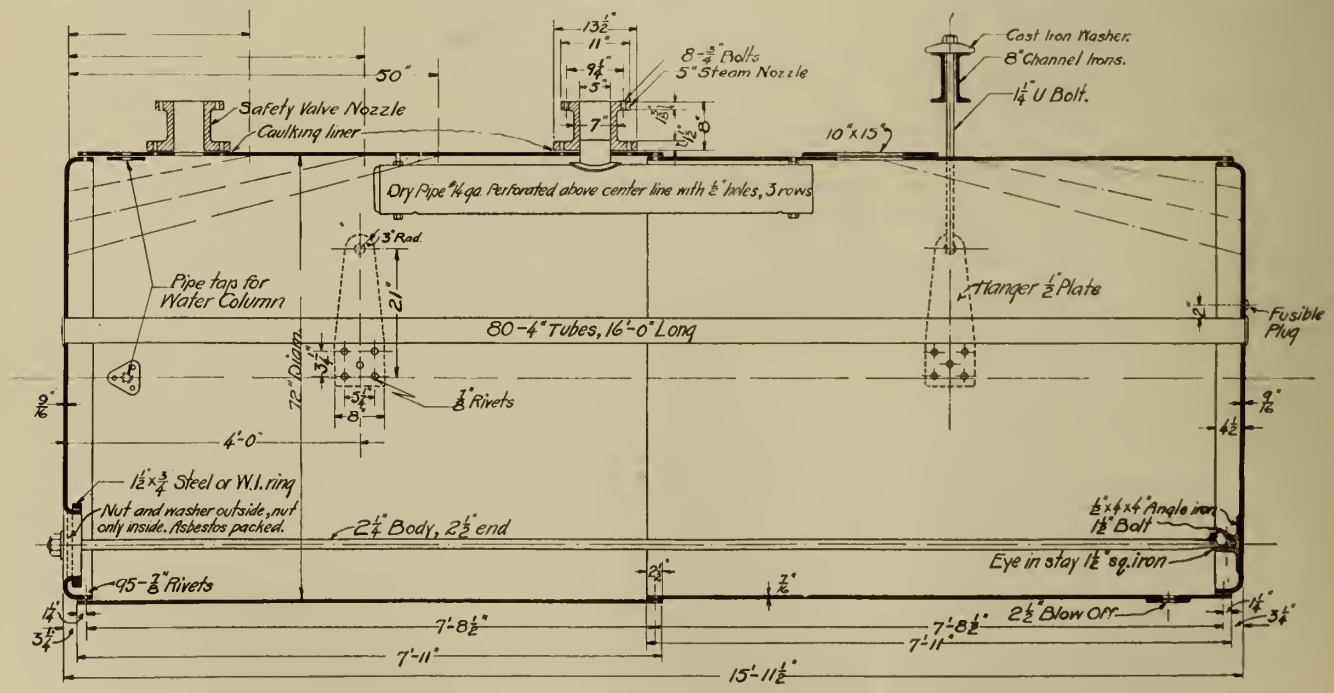



Fig. 13.—Layout of a 72" x 16' Return Tubular Boiler.

rivets on one side of the centre equal to this; twice this number of rivets is the number required. The strength of the plate is $4.375 \times 60{,}000 = 262{,}500$ pounds. The shearing strength of 13-16 inch rivet is $40{,}000 \times .5184$ (area of rivet) $= 20{,}736$. Then $262{,}500 \div 20{,}736 = 12.6$ or say 13 rivets should be on each side of the centre line or 26 rivets in all.

**Suspending the Boiler.**

The oldest way was to have cast iron brackets riveted to the shell, which rested on the walls of the settings. This is objectionable for the reason that the walls are liable to sag and allow the boiler to get out of place. Owing to the lesser first cost of the setting, brackets are still used to a great extent and the expansion is allowed for by placing rollers under the rear of brackets. Fig 9 shows the evolution of a modern pressed steel bracket. The best way is to suspend the boiler on hangers from beams of channel irons or I-bar section. These beams are supported by columns independently of the boiler setting and allow of expansion without the danger of cracking the walls. The figuring for the number of rivets in the hangers is simple. They are in single shear and the load is that due to the boiler full of water. The position of the hangers depends upon the arrangement of the weight, the hangers being placed so as to have as little strain on the circumferential joint as possible.

**Safety Valve.**

The size of this varies slightly according to the different laws under which the boiler is being built. These should be placed directly on the boiler shell and independent of any other steam outlet. Valves up to 2 inches in diameter may be attached by riveting a reinforcing plate to the shell and tapping both plates to receive the valve. Above 2 inches the valve should be attached by a cast iron or steel nozzle riveted to the shell and provided with a flange to which the valve is bolted. The area of the valve according to the British Board of Trade rules should have an area of

$$\frac{37.5 \times \text{area grate surface}}{\text{working pressure} + 15}$$

square inches.

When the required diameter of the safety valve exceeds three inches there should be two valves used and the lift of all safety valves should be equal to one-eighth of their diameter. Spring loaded valves with the spring away from contact with the steam are preferable to lever loaded valves, in fact the latter are very seldom allowed by present day laws.

The subject of dry pipes, steam separators and safety valves is, in itself, matter enough for another article and will be taken up later in these columns.

**Fusible Plugs.**

About two inches above the tubes, in the centre of the rear head should be placed a fusible plug of a good design filled with a substance with a low melting point. This filling should be renewed at intervals of about 12 months or so.

Fig. 11 shows the arrangement of a standard water column carrying the steam gauge, the water glass and the try cocks. Reference to the drawing of the boiler will show the position of the connections of this to the boiler.

Fig 12 shows several types of standard stationary grate bars as used under return tubular boilers.

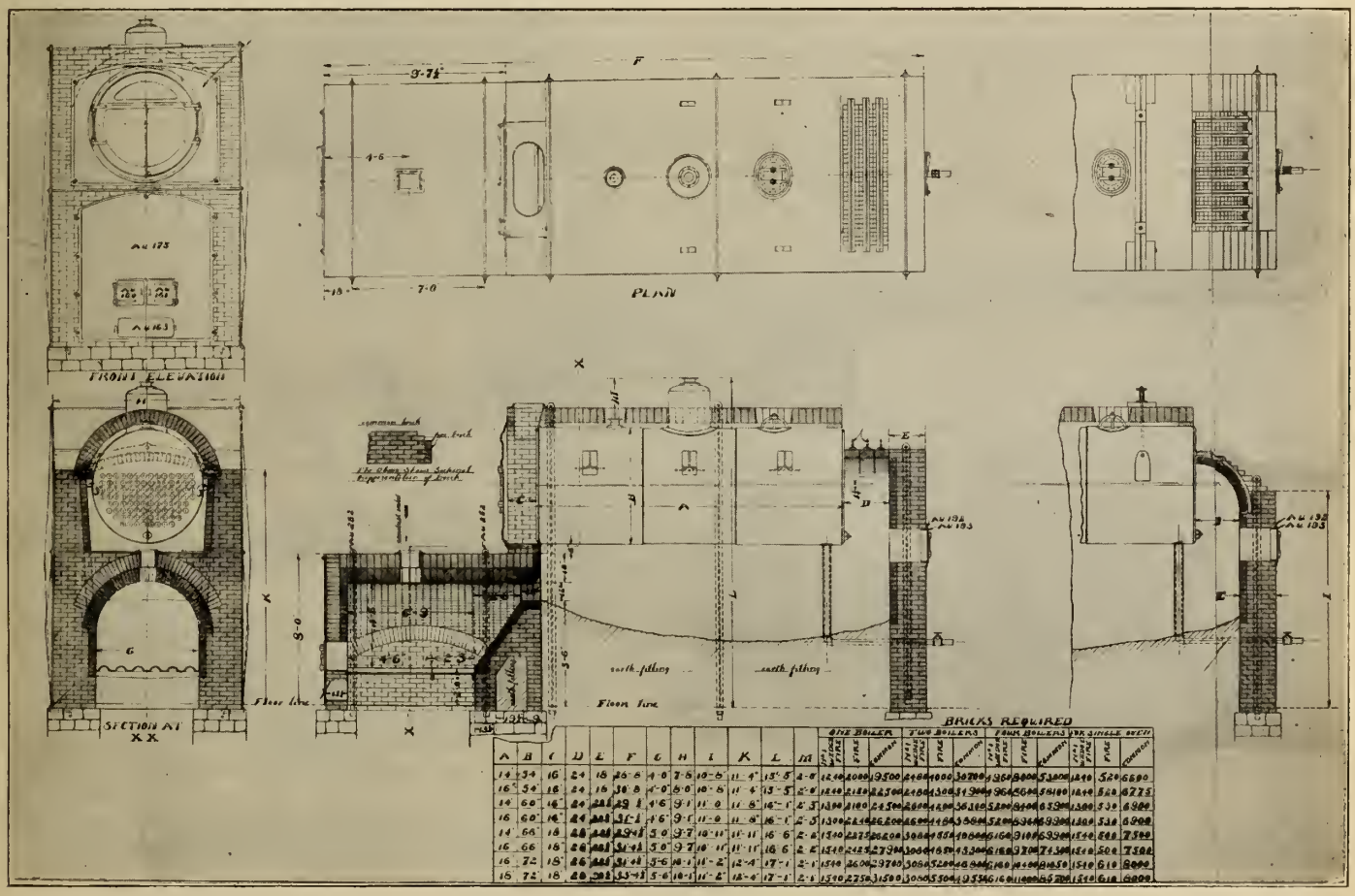



Fig. 14.—Design of Return Tubular Boiler.

**WELL PLEASED.**

The MacLean Publishing Co.

I am well pleased with The Power House, in fact I would not be without it.

W. S. TURNER.

# Some Points to Consider in the Selection of a Boiler

## The Chief Points in the Various Types of Boilers are Given with Descriptions of Prominent Types now Placed on the Canadian Market

In choosing a boiler for use in a plant several problems arise to influence the user in the type he will install. For an efficient boiler equipment it is necessary to have complete combustion and a high heat in the furnace. The heating surfaces must be so arranged that all the available heat is taken up and the water circulation must be free to have a fairly uniform temperature. The boiler must be as simple as possible with every part accessable for repairs. A sufficient factor of safety must be allowed in the design to provide against any unusual strain. There must be sufficient heating surface and steam capacity.

Boilers and furnaces are designed to suit the fuel to be used whether anthracite or bituminous coal, coke, wood, lignite, etc. The design of the combustion chamber depends on the fuel used as different fuels require different quantities of air.

The importance of arranging the heating surfaces so that they will absorb and utilize the available heat has led to a multiplicity of boiler designs and all have certain advantages and disadvantages. In some plants the operation of one design might quite eliminate the disadvantages, while under other conditions the design might not be at all suitable. It often happens that one particular design is more suitable than another. The different types of boilers now in use must be looked over and with a full knowledge of the efficiency of the different arrangements, select a type. An expert consulting engineer is best fitted to make this selection and it will be money well saved in getting his opinion.

There are two types of boilers, the externally fired which includes plain cylindrical boilers, flue and tubular, and the internally fired such as a locomotive or water-tube boiler. The plain cylindrical is the fundamental form from which all the other types are derived. It is supported on two parallel brick walls, built the diameter of the cylinder apart. This type holds most water and is a good boiler when sudden demands are made on it, and it is easy to keep up a steady pressure. The water circulation is good and this boiler can be used where water is not pure, for all parts are easy of access to be cleaned. However with such an amount of water it is hard to get up steam as this type does not expose much heating surface. Great care must be taken in hanging the plain cylindrical boiler to avoid strains. To give a greater heating surface and get more heat out of the gases the flue boiler has been designed with 2, 3 or 5 flues. One disadvantage is that these flues are exposed to the pressure within the boiler and are thus subject to collapse, and this increases with the size of the flue. However poor water can be used in them and they can be cleared easily.

By extending the internal flue principle the tubular is evolved, where, instead of having a small number of large tubes there are a large number of small tubes and there is little danger of these small tubes collapsing. The heating surface is very greatly increased by the use of this type. The tubes are expanded into the heads of the shell. Tubes must be far enough apart not to impede circulation and if too small they will impede draft through them. The best modern practice places the tubes in pairs of rows separated by a vertical space. Staggering gets in a greater number of tubes but is not favorable to the best circulation. The tubes must not be nearer together than one inch and must not be nearer the shell than four inches. The great amount of heating surface, efficiency and cost of this type of boiler makes it preferred in many power plants.

The tubular boiler occupies small space, gets up steam quickly and on account of the simple construction is cheapest of the simple types. The evaporative capacity costs only from $8.00 to $12.00 per horse-power. A disadvantage of this type is that impure water cannot be used in it, gases deposit carbon in the tubes, but for anthracite coal and pure feed water it is a good type of boiler to use.

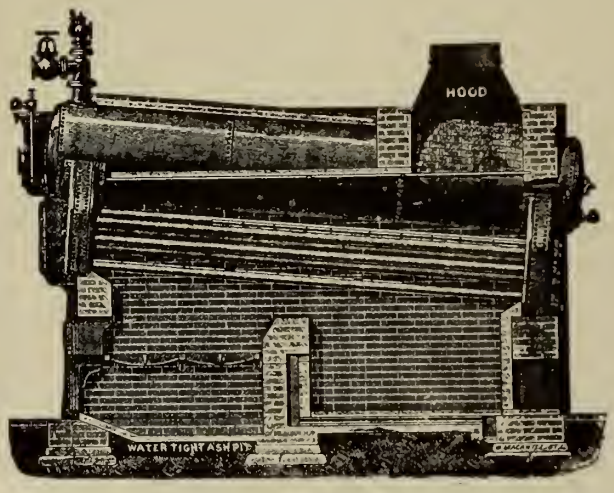



Fig. 1.—Heine Boiler and Setting.

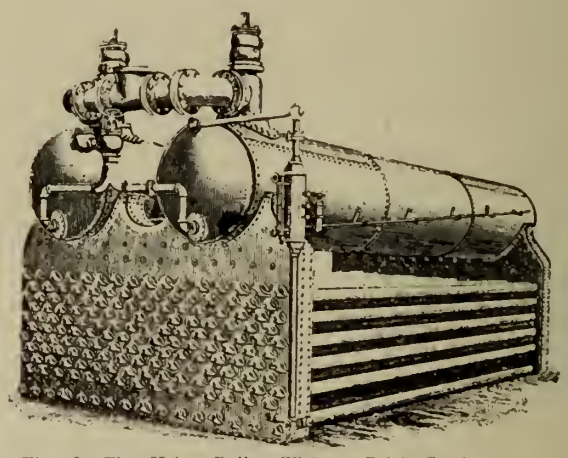


Fig. 2.—The Heine Boiler Without Brick Setting.

### Water Tube Boilers.

The safety of this type of boiler for high pressures has led to its wide adoption and popularity among the users of boilers. In the water tube boiler the weight per horse-power is greatly reduced as a reduction in the diameter of sections, allows the use of thinner metal.

The use of thinner metal allows a quick transference of heat to water. The different sections can be taken apart, shipped separately and assembled in place. Repairs are cheap, easy and rapid and can usually be made by available labor and skill, entailing but a short stoppage to work.

The water tube boiler can be forced above its normal capacity from 50 to

150 p.c. depending on the design of the boiler. In this type the sections must be designed to allow for the unequal expansion of parts, otherwise there will be strain set up in the metal, which will loosen the joints. Efforts to mitigate this evil has given rise to curved tubes. The preference is to use straight tubes as these are accessable for cleaning. The cost of water tube boilers range from $12.00 to $20.00 per horse power.

### Heine Boilers.

The Heine water-tube boiler is illustrated in Fig. 1 and 2, the first showing the brick setting. It consists of wrought iron tubes, extending between and connecting the inside of two water legs which form the end connections between the tubes and a combined steam and water drum placed alone and parallel to them, the whole being on a slight angle.

The water legs are each composed of a head plate and a tube sheet flanged all around and joined at bottom and sides by a butt strap of same material, strongly riveted to both. The water legs are further stayed by hollow stay bolts of hydraulic tubing, of large diameter, so placed that two stays support each tube and handhole. The water legs are joined to the shell by flanged and riveted joints and the drum is cut away at the points of joining to make connection with inside of water leg, the opening thus made being strengthened by bridges and special stays, so that the original length is preserved.

The steam and water drum or shell is a cylinder with head dished to form a true sphere. On the top of the shell near the front end is riveted a steam nozzle or saddle to which is bolted a tee. This tee carries the steam valve on its branch. On the top is located the safety valve.

One important feature of the Heine boiler is the mud drum. Here the speed of the water is about one-fiftieth of that in the feed water pipe, the mud, lime salts and other precipitates are deposited in a sort of semi-fluid sludge and blower off at intervals. The scale from the inside of the tubes is carried by the circulating water to the under drum and is blow off with the other refuse.

There is a good circulation, the generated steam passing forward towards the front of the tubes and the shallowness of the water in front of the shell makes it easy for the steam to pass through. The steam nozzle is high enough not to be reached by any spray while the deflection plate catches and diverts any sudden spurt.

In setting the boiler the front water leg is placed firmly on a set of strong cast iron columns, bolted and braced together by the door frames, deadplate, etc., and forming the fire front. The rear water leg rests on rollers which are free move on cast iron plates firmly set in the masonry of the low and solid rear wall. Wherever the brickwork closes on the boiler, broad joints are left which are filled in with tow or waste saturated with fireclay or other refractory but pliable material, thus allowing expansion or contraction without loosening any joint in the masonry. The boiler may also be hung by building columns in the walls and erecting beams across the top.

The boiler is made of good material having a tensile strength of from 55,000 to 62,000 lbs. per sq. inch. It is manufactured by the Polson Iron Works, Toronto.

### Lyons Boiler and Furnace.

The Lyons boiler is a combination of the tubular and water tube types. The water tube member is in the form of a flat arch and serves as a roof to the furnace. The furnace is lined with brick and the construction is made with a view to secure complete combustion and decrease smoke.

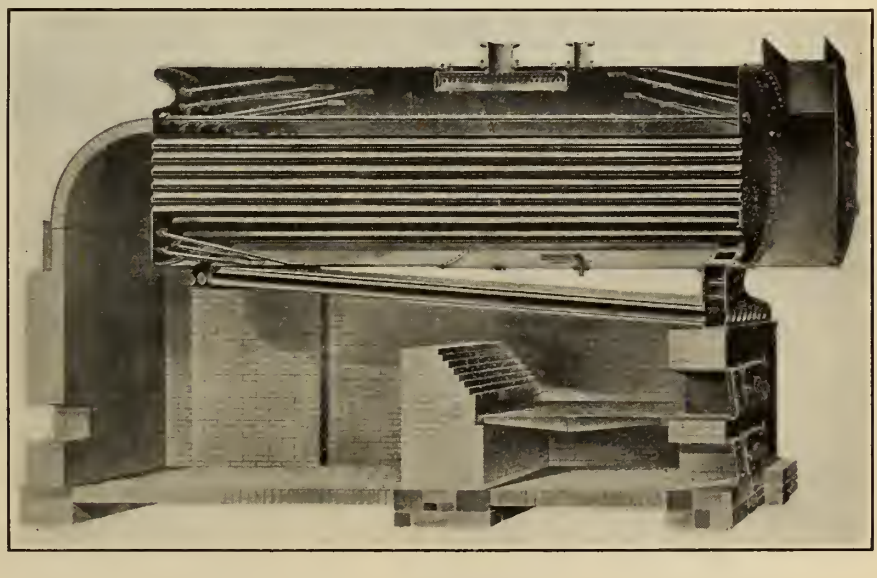


Fig. 3.—Lyons Boiler.

The illustration Fig. 3 shows the arrangement for the travel of water and gases. It shows the standard construction of a Lyons boiler with a row of water tubes inclined from front to rear serving as a roof to the furnace.

The water tubes are covered with tile or split brick, two rows of $\frac{1}{4}$ inch mill board and a coating of asbestos cement. The idea in the design of this boiler is to prevent any possibility of the shell being burnt. It is supported independent of the brick work.

The boiler steel and tubes are connected by flange steel saddles. The front saddles contain hand holes opposite the tube openings. Holes with plates or plugs are located in the rear saddle opposite the tubes. The back saddle is shorter than the front saddle to give the incline to the water tubes when the shell is set level.

Three 125 horse-power Lyon's boilers were recently sold to the Ontario Government, one to be installed at the Brockville Asylum and two in the Mimico Asylum, near Toronto. The Lyons' boilers are manufactured by the Lyons High Pressure Steam Boiler Co., 16 Pearl St., Toronto.

### Canada Water Tube Boiler.

The Canada Boiler, shown in Fig. 4, consists mainly of three drums and two water-legs extending crosswise and the tubes running lengthwise ; thus all tube surfaces run in one direction and all plate surfaces in another, producing universal flexibility. The entire width and height of this boiler has been definitely established by actual measurements taken at top and bottom before firing and again after full working pressure has been reached. The expansion and contraction of the tubes is taken care of by mounting the rear water-leg on rollers, thus effectually preventing injury or danger from these stresses.

An orginal feature in the general design is that the water-legs are formed by the continuation of the plates of which the shells of the front and rear drums are composed.

Another exclusive and very valuable feature of the design is the arrangement for passing the steam, after leaving the vessels containing water, through a series of superheating tubes, wherein it loses every particle of moisture and is heated to a temperature many degrees higher than that normal to its pressure.

No matter how large the boiler, there is only one steam drum, consequently the entire product of the boiler can be piped out of a single steam. The shells and heads of the drums and water-legs are open hearth homogeneous flange steel, bearing the maker's stamp of

passageway between parts. The openings for cleaning opposite the end of each tube, are closed by hand-hole plates, the joints of which are made by milling the surfaces to accurate metallic contact, and are held in place by wrought steel forged clamps and bolts

steam separates from the water, and the latter flows to the rear and down through the tubes again. The steam is taken out at the top of the steam-drum near the back end of the boiler. The B. & W. boiler is shown in the accompanying illustration, Fig. 5.

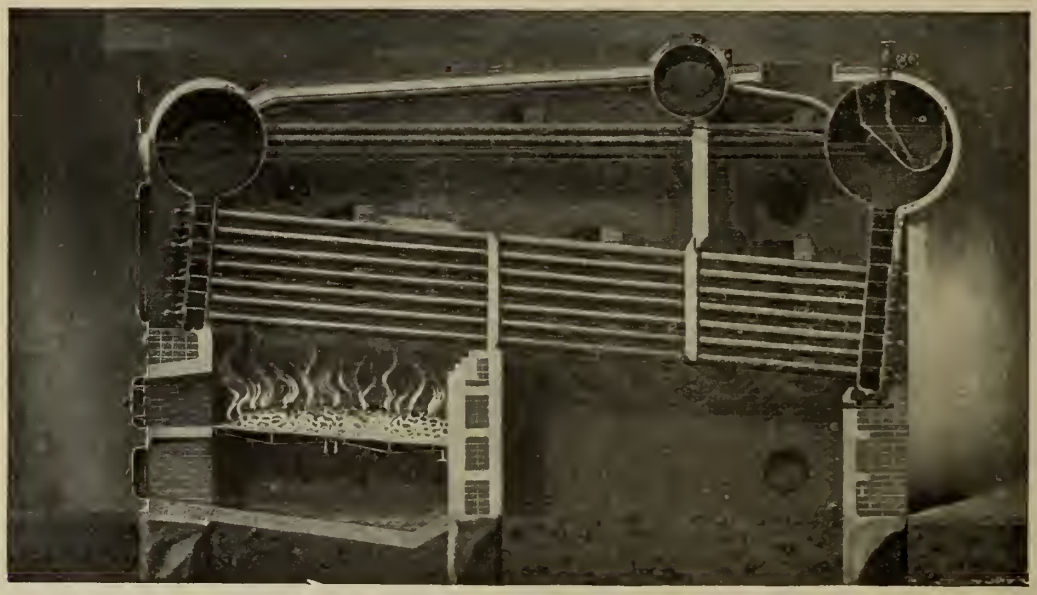


Fig. 4.— Longitudinal Section Canada Boiler, Showing Construction.

60,000 pounds tensile strength per sq. inch of section, with not less than 50 per cent. of ductility as indicated by contraction of area at point of fracture under test, and an elongation of 25 per cent. in a length of 8 inches.

The Centennial Standard of horse power which calls for the evaporation of 30 pounds of water per hour at 70 pounds pressure from a feed-water temperature of 100 degrees, or an evaporation of 34½ pounds of water from a feed-water temperature of 212 degrees into steam of the same temperature, is adopted as the basis for calculations in rating the capacity. The boiler superheats the steam 10 to 30 degrees. It is equipped with a water purifier arranged in the rear drum.

The Canada Water-Tube Boiler is manufactured by the Canada Foundry Co., Toronto.

**Babcock and Wilcox Water Tube Boiler**

The Babcock and Wilcox boiler is composed of wrought steel tubes in an inclined position, and connected with each other, and with a horozontal steam and water drum, by vertical passages at each end, while a mud-drum is connected to the rear and lowest point of the boiler.

The wrought mild steel end connections are in one piece for each vertical row of tubes. The sections are connected with the steam and water drum, and with the mud drum also, by short tubes expanded into bored holes, doing away with all bolts, and giving a clear

In erecting this boiler, it is suspended from wrought iron girders resting on iron columns, independent of the brick work. The steam and water drums are made of mild steel of good quality and can be made for any desired working pressure.

The products of combustion pass up between the tubes into a combustion chamber under the steam and water drum, down between the tubes, then

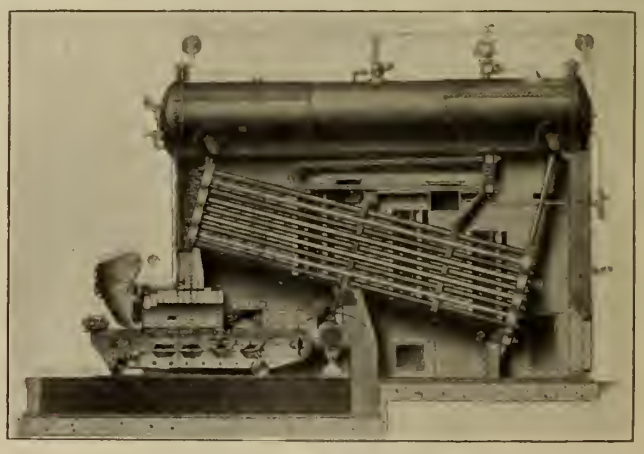


Fig. 5.—Babcock & Wilcox Boiler.

once more up through the spaces between the tubes and off to the chimney.

The water inside the tubes, as it is heated, tends to rise towards the higher end, and as it is converted into steam rises through the vertical passages into the drum above the tubes, where the

## A SMART PAPER.

Editor The Power House.

Dear Sir,—

A friend in Canada sent the writer a copy of The Power House. This paper is one of the smartest that has come to the writer. Hope that you will have a large circulation and keep up the interesting articles written for the operating engineer, which work the writer has followed about ten or more years.

Success to your paper.

WM. J. MARSHALL.

## IS THE JUNE NUMBER INTERESTING?

Many readers have written us that they are well pleased with the paper. If the June number contains something helpful, we want to know. We are endeavoring to give engineers the information they want and need. Your opinion of this issue will be appreciated.—Editor.

# New Water Tube Boiler with Special Features

## Goldie & McCulloch, Galt, have Placed on the Market a New Water Tube Boiler of Interesting Design.—Description of the New Boiler.

The new water tube boiler placed on the market by Goldie & McCulloch possesses many special features. Among the important points considered in the design is one in connection with the tubes and their arrangement. To examine the inside of the tubes for their total length remove the manhole doors on the six drums. Free access can be gained to every tube, and as they are straight they can be thoroughly examined. The removing and replacing of the manhole doors can be done by any ordinary fireman, only simple tools being required.

The following points and advantages which are essential to insure successful working of any boiler and are claimed

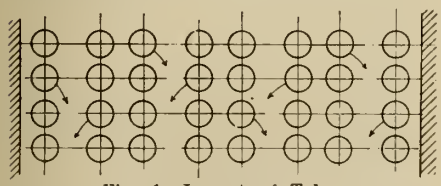


Fig. 1.—Layout of Tubes.

by the makers for this water-tube boiler.

(1.) All heating tubes perfectly straight and nearly vertical.

(2.) All parts of the boiler free to expand.

Fig. 2.—Front Elevation Not Bricked In.

(3.) An unobstructed view through each tube for inspection.

(4.) Maximum steam release area. Each tube being nearly vertical and perfectly straight and entering the steam drum direct without intervention of any headers ensures perfect steam release and so adds to the efficiency of the

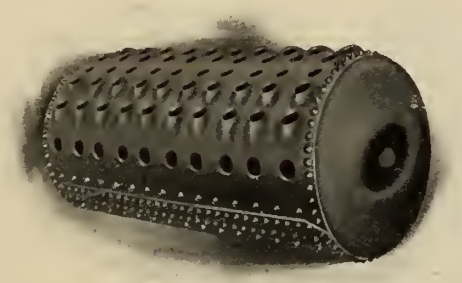


Fig. 3.—Water Drum.

boiler as there are no sharp turns to retard flow of the steam globules to the steam space.

(5.) Free access to all parts whether for examination, cleaning, or repairs.

(6.) Minimum deposit in tubes. As these tubes are nearly vertical and straight, deposits are not retained in them but are collected in the large mud drums and thus overheating and destruction of the tubes are reduced to a minimum. This is a distinct advantage over boilers with horizontal tubes, which invariably burn through in the bottom rows from the great tendency for deposits to collect in any tubes lying horizontally. The same danger exists with vertical tubes if they are not straight as any bend must collect denosit.

(7.) Simplicity of construction and design, permitting them to be worked and understood by any fireman.

(8.) Large combustion chambers so arranged that the whole of the heat is utilized in the most economical way and combustion of gases completed before leaving the heated surface.

(9.) Simplicity of design for cleaning, etc. The design offers great facility for cleaning as by breaking one manhole on each drum the whole of the tubes can be thoroughly examined internally.

### Description of Boiler.

The Goldie & McCulloch water-tube boiler is made of three sections, each consisting of a steam drum at top, water drum at bottom and a number of rows of tubes (five tubes to each row, the number of rows in each section depending on size of boiler required) expanded into flat surfaces on steam (with copper ferrules around the ends of tubes in steam drums) and water drums. The cylindrical tube sheet of both the upper and lower drums are formed in a powerful hydraulic press so that the metal around each drilled hole for the tubes is at right angles to the length of the tube. By this form of construction the tube sheet is, to all purposes, flat but does not require staying.

Removal of tubes is simple. The tubes are spaced as in Fig. 1, and each alternate space is one half inch wider than the tube diameter ; to remove an inner tube it is merely necessary to cut the tube as near the tube sheet as possible, pass it out through the wide space between the tubes as indicated by the arrows in Fig. 1 and then remove it from the setting through either the side or front doors provided for the purpose. Any tube may be replaced without disturbing any other tube or the tube sheet or damaging the fire tile baffles.

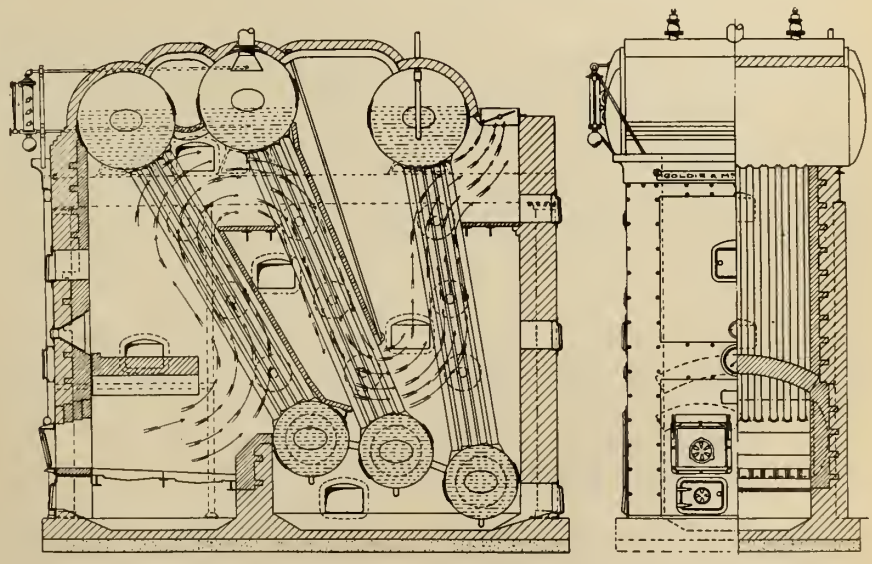


Fig. 4.—Sectional Elevation of Boiler.

Each steam drum is connected to its neighboring steam drum by horizontal connecting or circulating tubes and the water drums are also connected in a

similar manner. The whole boiler is hung, suspended on girders, and tied to the back so that it is entirely free at the bottom to allow for any expansion.

The feed water enters the rear steam drum at the point farthest away from the fire and the water flows down the tubes in the rear section and up the tubes in the front section. In the circulation, the water enters the boiler at the place where the temperature of the gases is lowest, precipitating any mud or dirt into the bottom of rear drum, and all the tubes in the front sections, which are in contact with the greatest heat have practically clean water to deal with and therefore no deposit is found in any of the tubes exposed to great heat. The baffle walls rest directly upon the tubes and guide the course of the gases up the front bank, down the middle and up rear bank, and bringing them into such intimate contact with the boiler surface that the heat is quickly and thoroughly extracted from them.

Fig. 5.—Boiler in Position Not Bricked In

Large doors are arranged in side wall of boiler for access into the bottom drums and also into the combustion spaces for inspection, etc. Small sight holes are also arranged in the walls for inserting steam jet for cleaning soot from the tubes.

# Calculation of the Horsepower of Steam Boilers

**Different definitions of horsepower and various methods used by different engineers for calculating the boiler horsepower.**

The term horse-power has two meanings in engineering; (1) a horse-power has a unit of rate of working or so much work done per second by a source of energy and is expressed in foot-pounds; (2) a horse-power in the case of a boiler is the unit of rate of conversion of water into steam and does not represent the available energy in foot-pounds.

In the first case, a horse-power represents 550 foot-pounds per second available energy, which is equivalent to a good draught horse. In the second case, the horse-power represents the conversion of 30 lbs. of water at a temperature of 100 degrees S. into steam at 70 lbs. pressure per hour, this being the requirement of the average engine. Both of the above units are arbitrary. The first was adopted by James Watt; the second was adopted by the judges on boilers at the Centennial Exhibition, 1876.

In order that the performance of different boilers might be compared, the American Society of Stationary Engineers decided in 1884 to adopt as a horse-power, the evaporation of 34.5 lbs. of water per hour from and at 212 degrees F. This represents the same number of heat units, practically, as the centennial standard or unit. The performance of boilers is equally reduced to the standard of weight of water evaporated from and at 212 degrees per pound of combustible. This is known in technical language as "equivalent evaporation from and at 212 degrees."

The latent heat of steam at 212 deg. is 965.7 B.t.u... i.e., it takes 965.7 thermal units to evaporate one pound of water from and at 212 deg. F. This is sometimes called the unit of evaporation. For every unit such as $965.7 \times 34.5$ there is one horse-power.

**Example.**

Feedwater per hour to boiler 6780 lbs.; feedwater temp., 97 deg. F.; steam, 350 deg.; dryness of steam, .988.

B.t.u. is the quantity of heat required to raise the temperature of 1 lb. pure water near its point of maximum density 39 deg. F.

Latent heat of steam at 350 deg.=867.

B.t.u. required to heat water from 97 deg. to 350 deg.=(350—97) 6780=1,783,140.

B.t.u. required to evaporate water at 350 deg. into steam, .988 dry=$.988 \times 867 \times 6780 = 5,807,720$.

Total B.t.u. supplied steam=1,783,140 +5,807,720=7,591,860.

Total equiv. evap. from and at 212 deg. =

$$\frac{7591860}{965.7} = 7861$$

$$\text{Horse-power} = \frac{7861}{34.5} = 227.8.$$

**Grate and Heating Surface.**

The horse-power of a boiler may be roughly found by allowing a certain amount of grate surface per horse-power. For the Lancashire type allow .36 sq. ft.; cylindrical tubular .30; water tube .28; locomotive .07; loco-stationary .28, and Scotch marine .11.

The horse-power may also be figured from the heating surface by allowing 7 sq. ft. per horse-power for a Lancashire boiler, 11.5 for a cylindrical tubular, 11 for water tube, 4.5 for locomotive, 11 for loco-stationary, and 3.3 for Scotch marine.

# Course of Lessons for the Instruction of Stationary Engineers

## Seventh of a Series of Interesting Educational Articles—This Article Contains Theoretical and Practical Information in Regard to Boilers.

By W. A. CROCKETT.

A boiler is a vessel in which steam is generated. The gases produced by the combustion of the fuel—solid, liquid, or gaseous—in the furnace of the boiler, act as carriers of the heat to the various parts of the heating surface through which the heat is transmitted to the water by conduction. It is essential that the furnace should have sufficient dimensions to allow of enough air being present to consume the fuel properly, and that the area of the surface designed to absorb the heat should be such that the products of combustion may be rejected at as low a temperature as practically possible, which of course must be higher than the temperature of water in the boiler. With careful firing, in a well-designed boiler having about 11½ sq. ft. per boiler horse-power, it is estimated that each pound of coal of good average quality will evaporate about 9½ lbs. of water from and at 212 degrees F. (each pound of water thus evaporated being equivalent to 966 heat units). The quantity of coal consumed per hour on each square foot of fire-grate surface depends partly on the draught, and partly on the volume of the combustion space above the grate. Not more than 10 lbs. of anthracite per square foot per hour should be figured on for the highest economy nor more than 15 lbs. of bituminous coal. The heating surface comprises those portions of the boiler which are in contact with the furnace gases whilst on their way to the chimney.

Natural or chimney draught is caused by the difference in weight between the products of combustion in the chimney and an equal volume of cooler air outside. On this account it is necessary that the waste gases should leave the boiler at a comparatively high temperature (about 600 degs. F.). With forced draught the air is not drawn through the furnace as with natural draught, but is mgde to enter under a small pressure. It is therefore possible to use more heating surface for a given grate area, and the products of combustion can be discharged at a lower temperature, thus increasing the efficiency of the boiler. With a properly arranged system of forced draught, an increase in capacity, as compared with natural draught, may result. In land practice it is usual to add to the he t ing surface by introducing an eco mizer which acts as a feed-water heater by utilizing some of the otherwise wasted heat in the flue gases.

Theoretically, 1 lb. of carbon requires about 11.6 lbs. of air for its complete combustion, but practical tests of boilers show that at least twice as much is actually used in an ordinary boiler, and from 15 to 30 per cent. of the total heat of combustion escapes in the flue gases. A well arranged boiler will utilize about 70 per cent. of the available heat in the fuel ; with an economizer added, the efficiency may be raised to 79 per cent. A good supply of air is, of course, absolutely necessary, but too much must be avoided, otherwise the flue-gas loss is increased; also, to bring about perfect combustion, the air must enter above as well as below the fire. Careful attention must be given to the firing : it is not conductive to economy to introduce large quantities of fuel at a time, especially if the fuel be soft or bituminous coal, because the rich volatile hydrocarbons in the fuel are then distilled off without being consumed. A much thicker fire (10 to 14in.) may be used with forced than with natural draught (about 8 in.).

### Conduction.

The rate at which heat is conducted through the walls of a boiler depends mainly upon the difference in temperature between the hot furnace gases and the water. The iron or steel of which a boiler is usually made is a good conductor, but the presence of even a very thin layer of scale on the boiler plates greatly impedes the passage of heat through the metal, in fact, scale on the plates has a far greater effect in hindering the conduction of heat, and thus reducing the evaporative power of a boiler, than the thickness of the plates themselves. Active circulation, by producing an equable temperature throughout the boiler, tends to prolong its life, because it prevents the production of deteriorating strains caused by unequal expansion and contraction.

It is very important that the temperature of the flames in the furnace should be kept as high as possible, complete combustion of the gases coming off from the fuel, can only be effected when the flames do not come in con interfere with the combustion of the tact with the heat-absorbing surfaces, which should be arranged so as not to fuel gases. It is also important that the gases be compelled to circulate equally over all parts of the heating surfaces. If boiler settings are not properly arranged, the gases are apt to "short-circuit" and reach the chimney without parting with much of their heat.

To prevent considerable variations in the steam pressure, it is essential that the steam space in a boiler above the water should be spacious. Too small a steam space causes violent outbursts of steam and priming (water coming over with the steam, forming wet steam). A boiler with excessive heating surface and deficient water space generally primes heavily when pressed. The steam should be taken off from a boiler at a point as far as possible from the water.

The chief sources of waste in a boiler are—unsuitable proportions of furnace, combusion chamber, fire-grate, and heating surface, deficiency or excess of air supply, ineomplete combustion, radiation, priming, leaky joints, valves, cocks, etc.; scale and soot on heating surface, flue-gas waste, and leakage of air into flues through defective brickwork. All radiating surfaces in boiler and steam-pipes should be properly covered with some efficient non-conducting covering.

### Boiler Construction.

Mild open-hearth steel is now almost universally used for boiler construction. It not only possesses greater strength and ductility than iron, but it is more homogeneous in character, and can be made in larger sheets. The English Board of Trade requires for shell plates a tenacity of not more than 32 tons, and not less than 27 tons per square inch, with an elongation of not less than 20 per cent. on a length of 10 in. The rules of other authorities are very similar. For plates exposed to heat and flame, a steel of slightly less tenacity and greater ductility is selected.

### Boilers for Stationary Engines.

For supplying steam to stationary engines, the boilers known as the Cornish and Lancashire types are most common in England, but are practically unknown in the United States. The Lancashire boiler consists of a long horizontal cylinder with flat ends, and provided with two large parallel tubes stretching from end to end, and com-

municates at the other with the external flues of the boiler.

It has a large water volume and once steam is raised it is converted into a hugh reservoir of heat energy and is correspondingly dangerous in case of explosion. It is capable of supplying large quantities of steam with very little effort but unless fitted with an economizer it is not economical. Return tubular boilers were until recently, almost universally used on this continent. Such a boiler consists of a cylindrical shell the length of which is four or five times the diameter with flat heads supported by stays and connected by a large number of tubes of diameters varying from 3 to 6 inches in different makes of boilers. The boiler is supported in a horizontal position by a brick setting which also supports the grate under one end of the boiler. The gases of combustion are caused to travel along the under surface of the boiler over its entire length and then return through the internal tubes escaping through a breeching placed vertically above the fire door. In this way about one-half of the surface of the shell and all the tubes are useful in transmitting heat. The merits of this type of boiler are cheapness and simplicity. Its disadvantages are the difficulty of cleaning scale and other deposits from the interior and great destructiveness in case of explosion. Internally fired boilers of the horizontal type are sometimes used where it is desired to economize space or portability is required. Extending lengthwise through the lower part of the boiler are one or two large flues in one end of which the grates are placed and which serve as a combustion chamber. If the steam pressure be high these flues usually have circular corrugations to prevent collapse. The gases of combustion first pass through the large flues and then return through smaller flues arranged above and around the main flue escaping to a breeching directly over the furnace door.

### Boiler Design.

Boiler designing is a science and a great deal depends upon the accuracy of the details. The greatest efficiency from fuel and engine is demanded in modern practice. The designing of a boiler is a problem only to be solved by the factors entering into the matter of furnace arrangements, so that every heat unit can be utilized,—effects of contraction and expansion, engine design, location, economy of fuel and space. The different types of boilers must be considered from the standpoint of maximum usefulness—grate, proportion for heating surface in the various types, the necessity of steam space and tube arrangements to avoid obstruction of steam passages so as not to retard circulation.

The power of boilers to-day is figured or estimated from the standpoint of evaporation. There are five classes extensively used—internal, external, water-tube, pipe, and sectional, also known as locomotive or marine, vertical, horizontal tubular cylinder and flue. Fuels are valued according to their heating values, the amount of water they will evaporate per pound of class fuel so the boiler must be measured by its efficiency from an evaporative point. The formula for the commercial rating of boilers is as follows :

$$\frac{Ex\ Lx\ (TSH-HU \div 966)}{34\frac{1}{2}}$$

E Power of engine equal 200.
P Pressure equals 120 absolute (guage 105).
L Lbs. of steam per horse power equals 20.
T Temperature of feed water equals 190 degrees.
W Water to be evaporated per h.p., per hour equals 34½ lbs.
TSH total heat units in steam.
HU Heat units in feed water.

A boiler 60 ins. x 16 ft. has 38923 sq. inches and if carrying 100 lbs. pressure has 1946 tons of energy. The following requisites are of course necessary :— A1 material, first-class design, faultless construction, modern appliances, good fuel, clean and soft feed water, also good setting, management and care.

The U. S. Government rules for the construction of boilers says that iron or steel plate intended for construction of boilers must not be less than 45,000 lbs. for iron or 55,000 lbs. for steel.

Steel plates, therefore, must have a tensile strength of not less than 55,000 lbs. per square inch of section and not over 70,000 lbs. per sq. in. Iron plates not less than 45,000 lbs. per square inch of section and not over 60,000 lbs. per square inch of sectional area.

To find number of square feet of heating surface in tubes, multiply number of tubes by the diameter of a tube in inches and by its length in feet and by .2618. Formula :
N×D×L×.2618=heating surface=44 ×4×16×.2618=737.2288 sq. ft. of heating surface.

Rule to find pressure allowed on a main steam pipe or header when the thickness height and diameter is known. From the thickness of plate subtract the constant .125, then multiply by 1-6 of tensile strength of plate and divide this product by diameter. The sum will be pressure allowed. Formula :—

$$\frac{(T-.125)\times(1-6\times60{,}000)}{D}$$

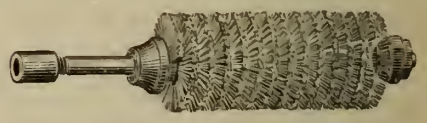
T—thickness of plate..... .485
C—constant ..... ..... ..... .125
TS—tensile strength ... ..... 60,000
D—diameter ..... ..... ..... 24 ins.
Result ..... ..... ..... 150 lbs. pressure.

### TEMPERATURE OF COAL PILES.

The old method of determining the temperature of a coal pile by driving pipes and hanging thermometers in them has been greatly improved by means of a special coal augur designed and used by the coal department of the Arthur D. Little Laboratory, Boston. It is similar in form to that used in the mines but is provided with a means of inserting a small maximum thermometer near the point. Extensions, four feet in length (for convenience in carrying) may be attached to the augur so that the thermometer can be readily inserted into any depth in a pile. The point of the augur can be driven 2: feet in 3 to 5 minutes. About 10 minutes is required for the thermometer to attain the temperature of the surrounding coal. Temperatures taken in this manner are much more accurate than those obtained by hanging a thermometer down a pipe where there is more or less circulation of air making it impossible to locate the hottest spot. Temperatures obtained by means of the augur have been found to be 40 degrees Fahrenheit higher than by the pipe method.

### BOILER TUBE CLEANER.

The cleaner illustrated herewith is not new, but has been on the Canadian market for a number of years. The simplicity of the cleaner is its strong



Greening's Boiler Tube Cleaner.

point It is made of good crucible cast steel flat wire and forms a scraper.

This cleaner has been manufactured for fifty years by the B. Greening Wire Co., Hamilton.

### OUR BOILER ISSUE.

If this issue pleases you, let your brother engineer know about it. There may be something in it that will help him. If he isn't a subscriber he will want to become one when he sees this issue.

### THE DOLLAR ENCLOSED.

The MacLean Publishing Co.
Enclosed please find cheque for $1.00 for The Power House for one year.
JAMES CORBETT.
Electrician.
P.S.—Would suggest that you put a list of subjects or articles on cover. Handy in looking up references. Much pleased with paper.
J. C.

# The Construction and Inspection of Steam Boilers

## Inspectors will Rate the Working Pressure of Boilers by these Rules, which Apply to all Boilers Improved in the Province of Alberta.

These rules, in so far as they apply to the construction of Boilers for use in the Province of Alberta, will not come into effect until January 1, 1910, but will apply to boilers constructed after April 1, 1909. For boilers constructed previous to April 1, 1909, and which do not conform with requirements of these Rules are set forth, but are in accordance with

Fig. 1.—Single Riveted Lap Joint.

the provisions of The Steam Boilers Act, 1906, and amendments 1907 and 1908, the right is reserved to reduce pressure to what is considered a safe limit.

Material.

1. The use of cast iron in the construction of steam boilers will not be allowed in any boiler carrying a pressure exceeding 100 pounds per square inch, and may then only be used for nozzles, manhole and handhole plates. Such nozzles shall be riveted to the boiler shell.

2. Every steel plate intended for the construction of boilers hereafter built for operation under The Alberta Inspection Act shall be stamped by the makers with their names and the tensile strength of the plate, so located that the stamps are plainly visible after the boiler is constructed.

Steel plates are to be homogeneous, and made by the open herath or crucible processes and having the following qualities:

(a) Shell plates, or plates on which flanging is to be done, may have from 55,000 to 65,000 pounds per square inch tensile strength, elastic limit not less than one-half the tensile strength, elongation not less than 25 per cent. in 8 inches cold and quench bends 180 degrees flat on itself without fracture on outside of bent portion. Maximum phosphorous .04 per cent., maximum sulphur .05 per cent.

(b) Firebox plates to have from 52,000 to 62,000 pounds per square inch tensile strength, elastic limit not less than one-half the ultimate strength, elongation not less than 26 per cent. in 8 inches, cold and quench bends 180 degrees flat on itself without fracture on outside of bent portion. Maximum phosphorous .03 per cent., maximum sulphur .04 per cent.

(c) Steel for boiler rivets to have from 45,000 to 55,000 pounds per square inch tensile strength, elastic limit not less than one-half the tensile strength, elongation not less than 28 per cent. in 8 inches, cold and quench bends 180 degrees flat on itself without fracture on outside of bent portion. Maximum phosphorous .04 per cent., maximum sulphur .04 per cent.

(b) All braces, stays and stay bolts are to be made of iron or mild steel specially manufactured for the purpose. Iron shall have a tensile strength not less than 46,000 pounds per square inch, elastic limit not less than 26,000 pounds, elongation not less than 22 per cent. in eight inches for stays less than one square inch area, not less than 20 per cent. for stays of one square inch area

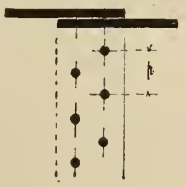


Fig. 2.—Double Riveted Lap Joint.

or more in a length of eight inches. Steel to have a tensile strength of not less than 55,000 pounds, elastic limit not less than 33,00 pounds per square inch, elongation not less than 25 per cent. in 8 inches for stays of less than one square inch in area, nor less than 22 per cent. for stays one square inch or more in area.

(c) Material for stay bolts must stand the following bending test. A bar taken at random threaded with a sharp V thread must bend cold 180 degrees around a bar of the same diameter without showing any cracks or flaws.

3. All rivet holes must be fairly drilled after bending and the burrs removed thus rendering the use of drift pins unnecessary. Caulking should be done with round nosed tools only and all edges of plates should be prepared by bevel planing or chipping before caulking. Tube holes in tube sheets must be drilled and the edges chamfered.

**Thickness of Plates.**

4. The minimum thickness of plates used in the construction of a boiler shall be one-fourth (¼) of an inch, and in all cases the heads and tube sheets shall be at least one-sixteenth of an inch thicker than the shell plate.

All plates in the shell or drum shall be of the same thickness.

The minimum thickness of plates in stayed flat surface construction shall be five-sixteenths (5-16) of an inch.

5. All openings in a boiler one and one-quarter (1¼) inches in diameter, including handholes exceeding two and one-half (2½) by three and one-half (3½) inches shall be reinforced with a plate at least the same thickness as the shell and of ample width, also where reinforced holes are threaded for pipe connections the threads shall be continuous through both plates.

6. In all cases where brackets or other fixtures subjected to any strain are attached to a traction or portable boiler, the plates to which these brackets are attached shall be reinforced with plates of the same thickness as the shell plates and properly riveted together. The area of such reinforcing plate shall exceed the area of face of the casting attached thereto. All brackets shall be properly fitted to the curvature of the shell, with stud holes drilled to suit the studs, and studs attaching same shall be tapped through both plates. (No stud bolts will be allowed).

**Manholes.**

7. All boilers shall be provided with the necessary number of manholes of standard size, flanged in and strengthened with reinforcing ring cut from the boiler plate of the same thickness as the shell, and riveted to the inside around the manhole opening, and the manhole

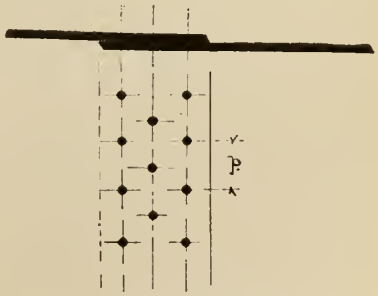


Fig. 3.—Triple Riveted Lap Joint.

doors are to be provided with two bolts having a shoulder on the outside screwed through the door and riveted to the inside.

(a) There shall be a standard manhole in the upper part of the shell or head of a firetube boiler 42 inches and

above in diameter, excepting vertical firetube boilers.

(b) Boilers 48 inches in diameter to 60 inches in diameter shall contain two manholes 10 inches by 15 inches in the clear, one in the front head below the tubes and one in the back head above the tubes. Boilers 66 inches in diameter and upwards shall contain two manholes 12 inches by 16 inches in the clear, one on top of shell and one in front head below the tubes.

(c) Manhole frames shall have the proper curvature.

(d) The rivet section of rivets holding reinforcing frame to shell shall be 20 per cent. above the net sectional area of part cut from shell. Stays to be arranged to admit of free access to boiler.

8. All cylindrical horizontal boilers less than 42 inches in diameter must be provided with a handhole in each head below the tubes.

9. All boilers must be provided with sufficient mud-hole or handhole openings to provide for properly cleaning everp part of the inside of the boiler, and all such openings in the shell of cylindrical boilers or cylindrical parts of boilers must have their shorter axis placed long-

Fig. 4.—Double Riveted Butt Joint.

itudinally. When mudhole openings are threaded for plugs the plugs must in all cases be of brass.

10. A locomotive type boiler shall have not less than six handholes, located as follows: One (1) in the smokebox head below the tubes, one (1) in the face plate at or about the line of the crown sheet, four (4) in the lower part of the water leg, one 1() located at each corner, also five (5) washout plugs not less than one and one-half (1½) inches in diameter, located as follows: one (1) on each side of handhole in line with crown sheet in front head, one (1) over fire door, and one (1) on each side sheet located between fourth (4th) and sixth (6th) row of stay bolts from bottom of firebox. All wet bottom boilers shall be provided with a plug in the lowest part of the shell.

(a) Fireholes in portable, traction and locomotive firebox boilers must not be less than 10 inches by 15 inches in the clear, to allow for examination of firebox.

11. All vertical firetube boilers shall have not less than seven (7) openings for cleaning out purposes, located as follows. One (1) at the water line four inches by six inches, three (3) in line with the lower tube sheet, two (2) at bottom of water leg, one (1) small plug under firehole door; boilers exceeding 36 inches in diameter shall contain one extra 4x6-inch handhole located at the water line.

### Minimum Diam. of Stay.

12. No stay less than seven-eights (⅞) inch as measured at it smallest diameter shall be used in the construction of any boiler. Screwed stays (not fitted with nuts) must be well set up and thoroughly expanded in the sheets, the ends being well riveted over the form, good substantial heads.

(a) For screw stays and other stays not exceeding one and one-half (1½) inches in diameter, 6,000 pounds per square inch net section will be the maximum load allowed. For screw stays and other stays above one and one-half (1½) inches in diameter, 7,000 ponnds per square inch net section will be the maximum load allowed.

(b) For screw stays and other stays not exceeding 1½ inches in diameter, 8,000 pounds per square inch net section will be the maximum load allowed. For screw stays and other stays exceeding 1½ inches in diameter, 9 000 pounds per square inch net section will be the maximnm load allowed.

### Stays.

13. All stayed surfaces formed to a curve, the radius of which is over eighteen (18) inches excepting surfaces otherwise provided for shall be deemed flat surfaces.

(a) The working pressure for all flat surfaces shall be calculated by the following formula:

$$\text{Working pressure} = \frac{C \times T^2}{P^2}$$

T=thickness of plates in sixteenths of an inch.

P=(greatest pitch) of stays in inches.

C=112 for plates 7-16 inch thick and under.

C=120 for plates over 7-16 inch thick.

C=140 for plates fitted with stays having one nut on the inside and one on the outside of plate.

C=160 for plates fitted with washers which have a thickness of at least 0.5 of the thickness of the plate and a diameter of at least 0.5 of the greatest pitch of the stay riveted to the outside of the plates and stay having one nut inside of the plate and one outside of the washers. T will then equal 80 per cent. of the combined thickness of the plate and washer.

C=200 for plates fitted with doubling plates which have a thickness equal to at least 0.5 of the thickness of the plate reinforced and covering the full area braced (up to the curavture of the flange if any) riveted to either the inside or the outside of the plate and stays having one nut outside and one nut inside of the plate, provided that the washers and doubling plates are riveted to the plates with rivets spaced and of sufficient sectional area as already provided for stays and flat surfaces. The pitch to be determined by thickness of the washer or the doubling plate. T will then equal eighty (80) per cent. of the combined thickness of the two plates.

14. The area for diagonal stays shall be not less than the area that would be required for a direct stay multiplied by

$$\frac{H}{L}$$

When

H=the length of diagonal stays

L=the length of a line drawn at right angles from the surface to be supported to the end of the diagonal stay.

(a) The angle which a diagonal stay makes with the shell shall not exceed 30 degrees and should be as much less as possible.

(b) When flat or diagonal stays are used where the plam end is riveted to the shell the rivet area in said palm shall

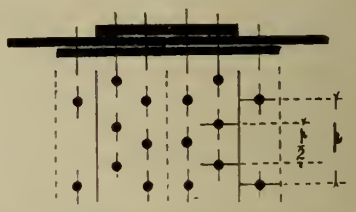


Fig. 5.—Treble Riveted Butt Joint.

aggregate 20 per cent. greater than the stay area if the rivets are in single shear. If, however, the ends are attached between two angle bars the bolt or pin may have an area of 25 per cent. less than the stay.

(c) The support given the head by the angle bars will not be considered, but the area of the rivets attaching the angle bars to the head should be 20 per cent. greater than that of the stay or stays.

(d) The minimum diameter of rivets used in attaching angle irons and stays to heads or shell shall be three-quarters (¾) inch.

We would recommend the use of longitudinal stays between the heads of horizontal boilers when the stays are properly fitted with substantial heads, nuts and washers. When these stays exceed 14 feet in length they should be supported at the centre.

15. Boilers will not pass inspection when the top of firebox or combustion box contains screwed stays that are not at right angles to the surface they support.

(a) When the tops of fire boxes or combustion boxes are curved they may be

stayed with radial stays extending from the crown sheet to the outer sheet of the boiler. One row of stays should always be placed along the centre of the crown sheet and care should be taken in laying out the remainder of the holes that the stays on either side of the centre row make equal angles with the vertical line.

(b) When the tops of fireboxes or of combustion boxes are flat (excepting the outside sheet is parallel to the same) they must be supported by girders properly fitted to the edges of the tube plate and the back plate or to the side plates, as the case may be, by chipping and filing, so that a good bearing may be effected on the edges of these sheets and also upon the flanged curve of the crown sheet.

(c) When the tops of fireboxes are supported by girders there shall be a clear water way between the girders and crown sheet of not less than 1¼ inches and preferably 1½ inches.

(d) The working pressure on girder stays suporting the top of fireboxes or combustion boxes shall be calculated by the following formula:

$$\text{Working pressure} = \frac{C x a^2 x T}{(W-P)\ D x L}$$

W=width of combustion box in inches.

P=pitch of supporting bolts in inches.

D=distance between girders from centre to centre.

L=length of girder in feet.

a =depth of girder in inches.

N=number of supporting bolts.

T=thickness of girder in inches.

$$C = \frac{1000N}{N+1}$$

when the number of bolts is odd.

$$C = \frac{1000\ (N+1)}{N+2}$$

when the number of bolts is even.

If the girders are made of steel the value of C is to be increased 10 per cent.

16. When gusset stays are used their area shall be in excess of that required for diagonal stays but as diagonal stays can be used in most cases where gusset stays can, they should be given the preference.

(a) The working pressure alowed on gusset stays shall be calculated as follows:

$$\text{Working pressure} = \frac{TxDxt}{A}$$

Where

A=area in square inches of surface supported.

T=working tensile stress.

D=depth of web of stay at narrowest part.

t=thickness of web.

17. When the area of any segment of a head to be stayed is required, the following formula shall be used:

Area of segment to be stayed in square inches equals

$$\frac{4H^3}{3}\sqrt{\frac{2R}{H}} - .608$$

H=distance from tubes to shell minus five inches.

R=radius of boiler minus three inches.

18. The working pressure allowed for tube plates shall be as follows:

$$\text{Working pressure} = \frac{(D-d)Tx22000}{WxD}$$

D=least horiontal distance between centres of tubes in inches.

d=inside diameter of ordinary tubes in inches.

T=thickness of tube plate in inches.

W=width of combustion box in inches between the tube plate and back of firebox.

**Standard Sizes of Steel Boiler Tubes.**

| Diameter inches | Thickness inches | Wire gauge number | Traverse internal area square inches | Length of tube per sq. ft. of internal surface feet |
|---|---|---|---|---|
| 1 | .072 | 15 | .575 | 4.462 |
| 1¼ | .072 | 15 | .961 | 3.453 |
| 1½ | .072 | 15 | .961 | 3.453 |
| 1½ | .083 | 14 | 1.398 | 2.863 |
| 1¾ | .095 | 13 | 1.911 | 2.448 |
| 2 | .095 | 13 | 2.573 | 2.110 |
| 2¼ | .095 | 13 | 3.333 | 1.854 |
| 2½ | .109 | 12 | 4.090 | 1.674 |
| 2¾ | .109 | 12 | 5.035 | 1.509 |
| 3 | .109 | 12 | 6.079 | 1.373 |
| 3¼ | .120 | 11 | 7.116 | 1.260 |
| 3½ | .120 | 11 | 8.347 | 1.172 |
| 3¾ | .120 | 11 | 9.676 | 1.088 |
| 4 | .134 | 10 | 10.939 | 1.024 |
| 4½ | .134 | 10 | 14.066 | .902 |
| 5 | .148 | 9 | 17.379 | .812 |

**Unstayed Heads.**

19. The working pressure for unstayed heads shall be determined by the following formula:

when the head is bumped

$$\text{Working pressure} = \frac{TS}{3R}$$

for single riveted heads.

$$\text{Working pressure} = \frac{TS}{2.5R}$$

for double riveted heads.

When the head is concaved:

$$\text{Working pressure} = \frac{TS}{5R}$$

for single riveted heads.

$$\text{Working pressure} = \frac{TS}{4\ 1\text{-}6\ R}$$

for double riveted heads.

To find the radius of a bumped head:

$$\text{Radius} = \frac{\text{Radius}^2}{\frac{3}{2}} + 2$$

When the head is flat:

$$\text{Working pressure} = \frac{TS}{.54\ A}$$

T=thickness of head in inches.

R=radius in inches to which the head is bumped.

S=Ultimate tensile strength of the material.

A=area of head in square inches.

**Plain Circular Furnaces.**

20. The working pressure in plain circular furnaces shall be calculated by the following formula:

$$\text{Working pressure} = \frac{5012}{D\sqrt{L}} - \frac{D}{L}$$

t=thickness of plate in 32nds of an inch.

D=outside diameter in inches.

L=length in feet.

When the furnace exceeds 36 inches in diameter, it shall be deemed flat surface and must be stayed accordingly.

21. The working pressure on corrugated or ribbed furnaces shall be:

$$\text{Working pressure} = \frac{14000\ t}{D}$$

D=outside diameter at bottom of corrugations in inches.

t=thickness of plate in inches.

22. The working pressure on truncated cones shall be:

$$\text{Working pressure} = \frac{C \times T}{D}$$

T=thickness of flue in inches not less than five-sixteenths (5-16) inch.

D=outside diameter in inches at the centre of the length of the flue, not to exceed 36 inches.

C=8000 a constant, when the length of the fiue does not exceed 36 inches measured from the centre of rivet holes in the top head to the centre of the tube holes in the tube head

(a) When the tube exceeds thirty-six (36) inches in diameter at the centre it shall be deemed flat surface and must be stayed accordingly

**Safety Valve**

23. Every boiler shall be provided with a lock pop safety valve of approved make with openings for the discharge of steam on the side thereof, and provided with a cap covering the adjusting nut and set screw in such a manner that it can be efficiently sealed by the inspector

**Area of Valve**

(a) The area of such safety valve measured at the point of contact between the valve and the seat shall be proportional to the size of the fire grate according to the following formula:

$$A = \frac{37.5 \times G}{P}$$

Where

A=area of valve in square inches.

G=area of fire grate in square feet.

P=absolute pressure in pounds per square inch (i.e. guage pressure+15.)

(b) When considered necessary the valves shall be tested under full steam and full fires for at least 15 minutes with the feed water shut off and stop valve closed; if the accumulation of pressure exceeds 10 per cent. of the working pressure of the boiler, the safety valve must be enlarged.

(c) All boilers requiring safety valves to be over three (3) inches in diameter are to be equipped with twin valves instead of one large valve. Where the twin valves, or more than one valve, are used the minimum combined cross sectional area shall be in accordance with formula (Sec. a).

(d) Safety valves having either the seat or disc of cast iron shall not be allowed.

(e) The minimum diameter of a safety valve used on a boiler shall be one (1) inch.

(f) All safety valves are to be fitted independent of any other connection to the boiler, and must be placed immediately at the boiler, and no valve of any description shall be placed between the safety vale and the boiler, nor on the escape pipe between the safety valve and the atmosphere, the escape pipe shall have an open ended drain at its lowest point. The safety valve shall be located so as to be accessible at all times and must not be connected to an internal pipe placed in the steam space of a boiler.

### Fusible Plug.

24. Every boiler shall be equipped with at least (1) fusible plug, which shall be kept in clean and efficient condition. The body of the plug shall be composed of brass with a taper hole through its centre, the smallest diameter of this hole to be at least three-eighths (⅜) inch, and to be filled with good banca tin, the outside of the plug to be threaded twelve threads to the inch.

(a) The fusible plug shall be located in any boiler so as to efficiently protect the fire line, when the water falls below the minimum level prescribed by these rules (see Rule 52) and shall project through the sheet not less than three-quarters (¾) of one inch.

(b) Low water alarms of any approved pattern may be used in addition to the fusible plugs. Their use is not compulsory, but they are recommended by the Department.

### Steam Gauge.

25. Every steam boiler shall be provided with a reliable steam gauge of approved make, which shall be tested by the inspector at the time of inspection and set to correspond with a standard test gauge.

(a) The dial of the steam gauge shall be graduated to not less than one and one-half times the maximum pressure carried on the boiler.

(b) Traction and portable boilers shall be provided with a steam gauge having double tube connections.

(c) All steam gauges shall be fitted with a syphon or equivalent device sufficiently large to fill the gauge tube with water, a cut-out cock to be placed between the syphon and the boiler.

26. Every boiler shall have at least one water glass not less than six (6) inches in length (as measured between the gland nuts) the bottom end of which shall be at leat two (2) inches above the fireline.

### Gauge Cocks.

27. Every boiler shall have three (3) or more three-quarter (¾) inch gauge cocks, located within the range of the gauge glass, the lower cock to be placed in the same plane as the bottom of the glass. When a water column is connected to the barrel of or side sheets of a traction or portable boiler, an extra set of gauge cocks must be inserted in the face-plate.

28. The internal diameter of any water column and pipes attaching the same to the boiler shall be as follows:

| Diam. of boiler | Int. diam. of pipe | Int. diam. of col. |
|---|---|---|
| Up to and including 36" | ¾" | 2" |
| 36" to 54" | 1" | 2½" |
| 54" to 66" | 1¼" | 3" |
| 66" and over | 1½" | 3" |

Straightway stop valves are to be fitted at the top and bottom of the column. The fittings at the lower connection to boiler shall be as short as possible and conveniently arranged for cleaning out. The waste pipe and valve at the bottom of the column shall be at least one-half (½) inch in diameter and the end of waste pipe open so that the discharge may be noted.

### Feed Water Supply.

29. Each boiler of twenty (20) horsepower in capacity or over shall be equipped with two (2) separate means of supplying feed water while the maximum steam pressure is carried on the boiler. Direct pressure from the city will not be considered as a feed supply.

(a) Each boiler shall have a feed pipe fitted with a check valve and also a stop valve between the check valve and the boiler. The feed water should be fed just below the water line at the coolest part through an internal pipe where possible, but never near the parts of a boiler that are exposed to the direct heat of the fire.

30. Each steam outlet for a boiler (except safety valve connections) shall be fitted with a stop valve immediately at the boiler. Any stop valve three (3) inches in diameter or over used on a steam main carrying a pressure exceeding eighty (80) pounds per square inch, shall be equipped with the outside screw and yoke type gate valve. The use of angle valves at the end of a long steam mean is not permissible. Where a pressure of 125 pounds or over is carried on a steam main, two stop valves shall be used with an ample valve drain between them, having an open discharge. The fittings from boiler, including valves and pipes, shall be extra heavy.

(a) All high pressure boilers, that is, boilers carrying or intended to carry a pressure exceeding 100 pounds per square inch, must be equipped with heavy fittings.

31. Provision shall be made for the expansion and contraction of steam mains connected to all boilers, with substantial anchorage at suitable points, so that there may be no perceptible vibration on the boiler shell plates.

32. All steam mains shall be efficiently drained. Where traps are connected to high pressure drains the discharge end of trap shall be opened for observation at all times.

33. Each boiler must be provided with proper blow-off pipe and straightway cock, the minimum diameter of which shall be one (1) inch and the maximum two and one-half (2½) inches. The pipe must be screwed through both shell and reinforcing plate and must also be adequately protected from the products of combustion. Globe valves shall not be used for this purpose. Each blow down pipe in a battery of boilers shall be connected independently to the drain, or open to the atmosphere.

### Setting H.C. Boilers.

34. The following rules shall be observed in the setting of horizontal cylindrical boilers as per Figs. 1 and 2. Boilers 42 inches diameter and up to 60 inches to be hung at back. Boilers over 60 inches to be hung front and back. All boilers up to 16 feet long shall have two lugs on each side. All boilers over 16 feet long shall have four lugs on each side set in pairs and properly placed to equally distribute the weight of the boiler. Supporting lugs or brackets to have the proper curvature and be properly riveted to shell. Sheaing stress on rivets not to exceed 8 per cent. of the shearing strength (See Rule 40. No boiler shall be suspended from crown or allowed to stand on a pedestal at the back end. Where boilers are not suspended they shall rest on substantial plates set in the brickwork, the back lugs having a set of rollers between the lugs and the plate to provide for expansion.

(a) The top of the back arch shall be set in such a way as to allow for the free expansion of the boiler and placed clear of the fusible plug. All flues and back settings shall be constructed with doors arranged so as to be easily accessible at all times.

**Distance From Back Head to Flue Sheet.**

(b) Distances from the back head of return tubular boilers to the back wall should be as follows:

20 inches for boilers 30 inches to 42 inches diameter.

24 inches for boilers 44 inches to 60 inches diameter.

28 inches for boilers 64 inches to 72 inches diameter.

35. We would recommend that all exits from boiler rooms should open outwards.

36. A complete set of shop drawings and specifications of each separate design or type of boiler intended for operation in this Province shall be submitted to the Department for approval and rating; when the design and specifications have been approved the manufacturers may then build any numbers of boilers to this particular design, without further submitting of drawings, and in the event of any novelty in construction, or of any departure from the practise of staying and strengthening noted in these rules, they shall immediately notify this Department. When any boiler enters the Province it shall be accompanied by the shop foreman's affidavit that the boiler has been built according to the approved drawings and specifications, that a hydrostatic test has been applied (in the ratio required by the Alberta Inspection Rules), that the steam gauge is correct, and that the safety valve has been tested and is set to the working steam pressure of the boiler, as rated by this Department. When the inspector has noted this affidavit he must file the same with the Department.

**Maximum Pressure Allowed.**

37. The maximum pressure to be allowed on a boiler constructed of steel or wrought iron shells or drums, shall be determined from the minimum thickness of the shell plates, the lowest tensile strength stamped on the plates by the plate manufacturer, the efficiency of the longitudinal joint, the inside diameter of the outside course, and the lowest factor of safety allowed by these rules, the formula being:

$$P = \frac{T \times S \times E}{R \times F}$$

P=Maximum allowable pressure per square inch.

T=Minimum thickness of shell plates in inches.

S=Tensile strength of plates in pounds.

E=Efficiency of longitudinal joint.

R=Radius=one-half (½) the inside diameter of the outside course of the shell or drum expressed in inches.

F=Lowest factor of safety allowed by these rules.

Superior workmanship on both the inside and outside of the boiler shall be taken into consideration when calculating the working pressure to be allowed.

38. When the tensile strength of steel or wrought iron shell plates is not known, wrought iron shell plates is not known, it shall be taken as 55,000 pounds for steel and 45,000 pounds for wrought iron.

(a) The lowest factor of safety to be used for boilers, the longitudinal joints of which are of butt and double strap construction, shall be four and seventy-five hundredths (4.75).

(b) The lowest factor of safety to be used for boilers, the longtudinal joints of which are of lap construction, shall not be less than five and five-tenths (5.5) when not exceeding 36 inches in diameter, and when exceeding 36 inches in diameter the minimum factor of safety shall be six (6).

(c) Where any boiler has been subjected to overheating, strained by forcing, crystallized by age or otherwise impaired, the factor of safety expressed in Clause 38 (a) and (b) shall be increased according to the discretion of the inspector.

39. When the diameter of the rivet holes in the longitudinal joints of a boiler is not known the diameter and cross sectional area of rivets after driving shall be taken as follows:

| Thickness of plate | ¼" .25" | 9/32" .28125 | 5/16" .3125" | 11/32" .34375 | 3/8" .375" | 3/8" .375" | 13/32" .40625 |
|---|---|---|---|---|---|---|---|
| Dia. of rivet after driving..... | 11/16" | 11/16" | ¾" | ¾" | ¾" up to & including 2" pitch | 13/16 over 2" pitch | 13/16" |
| Cross sectional area of rivet ofter driving..... | .3712 sq. in. | .3712 sq. in. | .4418 sv. in. | .4418 sq. in, | .4418 sq. in | .5185 sq. in. | .5185 sq. in. |

| Thickness of plate | 7/16" .4375 | 7/16" .4375" | 15/32" .46875 | ½" .5" | 9/16" .5625" | ⅝" .625" | |
|---|---|---|---|---|---|---|---|
| Dia. of rivet after driving | ⅞" up to & including 2¼" pitch | 15/16" over 2¼" pitch | 15/16" | 15/16 | 1 - 1/16 inches | 1 - 1/16 inches | |
| Cross sectional area of rivet after driving..... | .6013 sq. in. | .6903 sq. in. | .6903 sq. in. | .6903 sq in. | .8866 sq. in. | .8866 sq. in | |

40. The shearing strength of iron rivets shall be calculated at 38,000 pounds, and steel rivets at 42,000 pounds per square inch net sectional area, when the shearing strength is not known.

**Efficiency of Joint.**

41. The efficiency that a unit of length of a riveted joint has to the same unit of length of a solid plate shall be calculated by the following formula:

P=pitch in inches.

R=diameter of rivet in inches.

A=area of one rivet in square inches.

T=thickness of pate in inches.

N=number of rivets in one pitch.

=2 for double riveting.

=3 for triple riveting.

=4 for quadruple riveting.

K=Percentage of strength of joint.

$$\frac{100}{}$$

Kt=K for plate between rivet holes.

Ks=K for shearing on the rivets.

Kst=K for combined shear and tension..

The smallest results of Kt, Ks, Kst, to be taken in each case.

**Single Riveted Lap Joint.**

(a) $Kt = \frac{P - R}{P}$

$Ks = \frac{A}{P \times T}$

**Double Riveted Lap Joint.**

(b) $Kt = \frac{P - R}{P}$

$Ks = \frac{2A}{P \times T}$

**Triple Riveted Lap Joint.**

(c) $Kt = \frac{P - R}{P}$

$Ks = \frac{3A}{P \times T}$

(d) A single riveted butt joint shall be considered equal to a single riveted

lap. For rivets in double shear the total effective area to be taken for each rivet shall be=1.75 A.

**Double Riveted Butt Joints.**

$$Kt = \frac{P - R}{P}$$

$$Ks = \frac{3.5A}{PxT}$$

**Treble Riveted Butt Joints.**

(e) Narrow outside straps and wide inner straps

$$Kt = \frac{P - R}{P}$$

$$Ks = \frac{8A}{PxT}$$

$$Kst = \frac{A + (P - 2R)T}{PxT}$$

**Maximum Pitch For Riveted Joints.**

42.—

T=thickness of plate in inches.

P=maximum pitch of rivets in inches, provided it does not exceed ten inches.

C=constant applicable from the following table.

| No. rivets in one pitch. | Constants for lap joints. | Constants for double strap joints. |
|---|---|---|
| 1 | 1.31 | 1.75 |
| 2 | 2.62 | 3.50 |
| 3 | 3.47 | 4.63 |
| 4 | | 5.52 |
| 5 | | 6.00 |

$$P = (CxT) + 1\tfrac{5}{8}$$

(a) When the work is first-class such pitches may be adopted so far as safety is concerned, yet, in some cases it may be well not to adopt the greatest pitch found by the formula. The maximum pitch should not, however, exceed ten inches with the thickest plates for boiler shells.

43. The circumferential seams shall be constructed so that the percentage of the joint is at least one-half of the percentage of the longitudinal seams.

44. When the lap outside the rivets is not at least one and one-half (1½) times the diameter of the rivet hole measured from the outside of the plate to the centre of the outside row of rivet holes, the efficiency of the joint shall be reduced accordingly.

45. When the inspector has calculated the working pressure to be allowed on the boiler by these rules, he may, when he deems it necessary to do so, apply a hydrostatic test to the boiler in the following ratios:

Boilers rated by these rules to carry a working pressure between twenty (20) and one hundred (100) pounds per square inch at least 160 per cent. of the working pressure. Boilers rated by these rules to carry a working pressure exceeding 100 pounds at least 150 per cent. of the working pressure.

46. When more than one boiler is connected to a main steam pipe and for any reason the working pressure of one of them is reduced, the safety valves on the other boilers so connected shall be set to correspond with the safety valve on the boiler carrying the lowest working pressure.

**Horse Power Rating.**

47. For the purpose of these rules, the horse-power of a boiler shall be calculated as follows:

$$\frac{HS\ I}{12}$$

For all stationary boilers —— horse-power.

For locomotive fire-box traction and portable

$$\frac{HS}{9} = \text{horse-power.}$$

H S=heating surface.

# Some Interesting Reminiscences of a Boiler Inspector

### Boiler Inspectors Meet with Experiences which might Prove Serious. The Following Story is an Experience of an Inspector up North.

By AN INTERESTED LISTENER

We found him comfortably seated beside the wood stove in his cozy home, with his after-supper pipe between his teeth and the evening paper across his knee. When we told him we had come to hear some stories of experiences he had had, he smiled and offering us two other "comfy" chairs, said: "Boys, if you are willing to listen, why, I'm quite willing to talk."

"It's hard to know just where to start. You know I was a railroad engineer for years and years before I took over this business of traveling around poking my nose into dingy places and examining boilers that were made before 'steam was invented,' more or less. One time I was up north in Ontario and received word to go and look over a boiler in a certain little old sawmill, about 10 miles from the nearest railway station. I had to drive, but sufferin' safety valves!! I don't want to take that drive again. I'll bet you there weren't more than one hundred yards in the whole ten miles, when you could draw your breath without a jerk."

"He Was a Dutchman."

"Well, we finally arrived and it was rather laughable to see what I had undergone so much jostling agony to see. The owner was a Dutchman, who hadn't been in this country a great while, but who thought he knew(?) all about sawmills. When I went into the shanty where they had the boiler, I saw something that, for a minute made my hair raise under my cap. He had a two by four scantling wedged in between the lever arm of the safty valve and the roof!! The boiler, at that time was only registering about 20 pounds, but say, I relieved my feelings by sailing into Mr. Dutchman in great style."

"'Vell,' said he, 'Ven she koffs (blows off), de vimmens run de mill oudt und von't come back.'"

"He had several of his country women working there and sure enough, when I knocked the scantling away, she 'blew' and such a clatter their wooden shoes made while they were falling all over themselves to get to a place of safety." Here, our friend indulged in a good hearty reminiscent chuckle as he saw over again what must have been a very funny sight. We let him have his laugh out, helping him with broad grins of our own manufacture and then he went on:—

"'She vont drink neider,' said Mr. Dutchman, and I wasn't surprised when I examined the injector piping. The

suction pipe looked as though it had been through a hospital, there were so many bandages on it. Under these, the pipe was split and, of course, the air, which was drawn in, cut up high jinks with the working of the injector system.''

''There were several other little discrepancies, such as the fact that, although the water used was muddy, there had seemingly been no attempt to clean 'her' out for a week of Sundays. 'Pon my word, boys, I have often wondered how some of these fellows get along, make money and, what's more important, keep their lives. It does seem as though the less one knows about boilers in these little jerkwater backwoods plants, the better off they are.''

''Now, I recall to mind an instance of pig-headed obstinacy and desire for profit that had a tragic ending—for the victim.

''One day a second-hand dealer phoned our office to send an inspector down to inspect a second-hand loco. boiler and I was detailed to the job. Now, if there is anything in the boiler inspection business that I don't like, it is inspecting a second-hand boiler that has been painted and 'slicked up,' to look like new. The one in question certainly did look as though it had just come from the makers. I asked the man what he wanted, 'Oh,' he said, 'I want you to test it to 110 pounds and give me a certificate.'

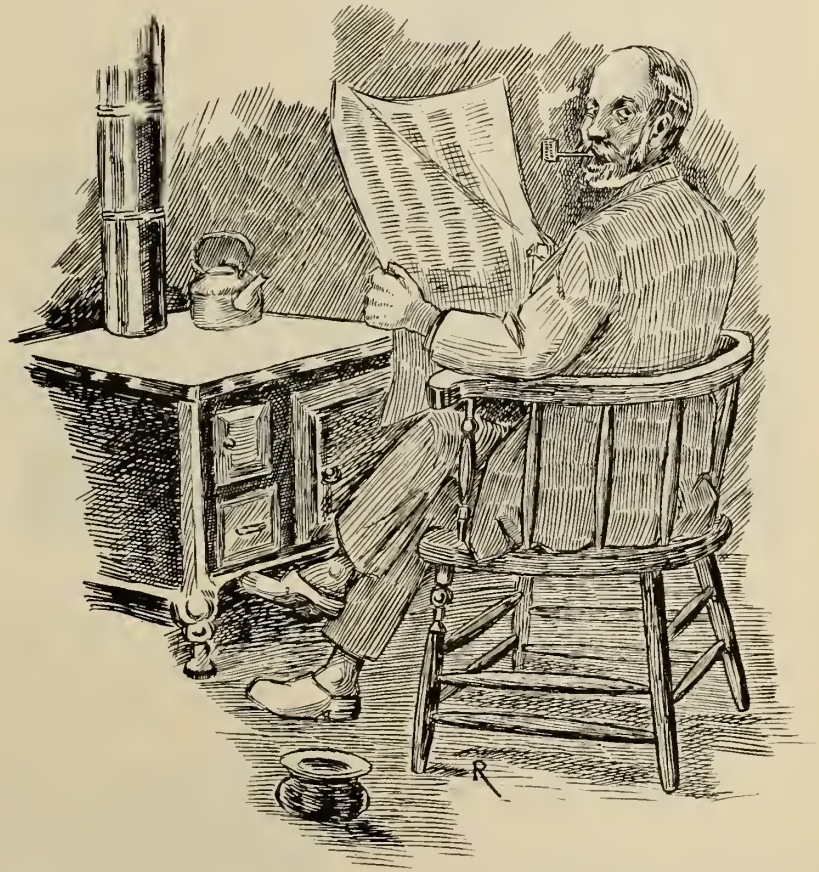
''I looked over the apparatus available for testing and found everything was O.K., but before filling her up, I examined her carefully. The fire-box looked pretty bad, and by the feel of the stays, felt through the hand hole in the rear, I was dubious about her standing 110 pounds, let alone the requisite overload called for by law in a cold water test. However, we filled her up and started the pump. Everything was rosy until the gage showed 52 pounds, when something gave. It was one of the diagonal stays over the firebox, and the rear plate was a full quarter inch to three-eighths out of square. I stopped right there and said all I'd allow was 15 pounds and even that was risky. I asked him where it was going. 'Oh, out in the country,' said he, evasively. Well I refused to grant any certificate whatever and warned him that it would be dangerous to use that boiler for anything except a tank.

''About two months or so later I saw a notice of a boiler explosion, which had killed one man and seriously injured another. The accident (?) occurred 'in the country' and I, being a curious person, sauntered into the office of the dealer spoken of before, and asked if Mr. So and So was in. As luck had it he wasn't, so I got the shipping or invoice clerk to look up about two months back and tell me where the boiler, that I had suspicioned figured in this explosion, was shipped. Sure enough it was to this man that it had been sold.

''I got on a train and went out to the scene of the explosion and after going over the ground, I asked the widow of the killed man, if she had any correspondence of her husband's about the boiler. She had. He had bought that boiler under the impression that it was good for 100 pounds steam pressure. The letters didn't say that exactly, but they did say that 'the boiler had been tested to 110 pounds.' Subsequently I found that they had, on the day I refused a certificate, actually pumped the old thing up so that the gage showed 110 pounds—for a second. Lord knows how many more stays went. The boiler exploded the very first time it was fired.

''I guess those will hold you for a while, my pipe's out, but drop in again soon and we will have some more.''

Others of our friend's reminiscences will appear in an early number.



His After Supper Pipe Between His Teeth and the Evening Paper Across His Knee.

## THE C. A. S. E. CONVENTION.

A reminder of the convention dates, July 26, 27 and 28 is in order. Every engineer, who can possibly attend should make it a point to be in London on those dates. The London council are working to make this gathering a big success.

The C. A. S. E. Exhibitors' Association are completing arrangements for a large exhibit in the city hall, London, and this promises to be a feature of the convention and a liberal education. In addition to those who have exhibited at previous conventions, several new leading manufacturers in steam specialties will have exhibits. Remember the place and date—London, July 27, 28 and 29.

---

A convenient rule of thumb for ascertaining approximately the size of engine required to drive a direct-current dynamo is to multiply the kilowatts of output by 1.7 for small machines 1.6 for medium sizes, and 1.5 for 500 kilowatts or over. The result will be about the brake horsepower required.

---

One of the first steps in obtaining an economical engine room is the proper firing of the boilers, and this cannot be obtained unless the fireman has the proper instructions as to the best method.

## LIKES THE PAPER.

The MacLean Publishing Co., Ltd.

Enclosed please find postal note for $1.00 being my subscription to The Power House for 1909.

I like the paper fine, just what I have been looking for—a dollar paper along that line.

F. J. RITCHIE.

# The Construction of a Modern Steel Smoke Stack

## Some Considerations in the Design—A Method of Erecting Built-up Stacks—Designing a Self-Supporting Steel Chimney — Some Tables of Sizes.

Steel chimneys or stacks are becoming more and more widely used, especially for the tall chimneys of iron works, manufacturing plants, mills, etc. The advantages claimed are mainly the reduced cost, running from 30 to 50 per cent., as compared with brick chimneys; greater efficiency; greater strength and safety. The reason for the increased efficiency is due to the fact that a steel stack may be calked air-tight, which prevents the draft from being impaired by the infiltration of air, which is a common occurence in brick chimneys.

Fig. 1.—A Stack Being Erected Bodily.

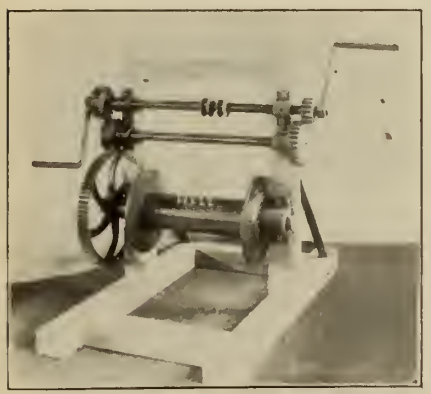


Fig. 2.—Simple Winch Used in Hoisting.

### Considerations in Design.

In designing chimneys to have the desired proportions for furnishing proper draught for the boilers they serve, there are so many variable quantities that enter into the considerations which make it impossible to have strictly accurate and rational formulae. However, there have been many investigations made of the performance of typical chimneys from which empirical rules have resulted that have met with approval and which have been widely used.

Fig. 3.—Painting a Guyed Stack.

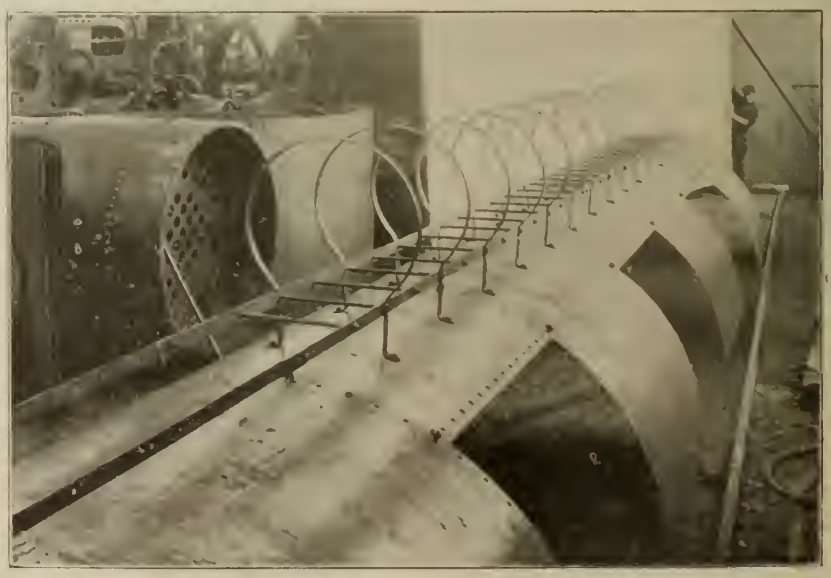


Fig. 4.—Stack Being Fitted Before Shipment.

The important function of a chimney or stack is to produce a current of air through the furnace, so that a sufficient quantity is brought into contact with the fuel to produce the desired rate of combustion. This current of air is equal in intensity to the difference between the weight of the column of hot gases within the chimney and a column of air outside, of the same height and sectional area.

The main points to be considered are the height of the stack and the area. The height must be great enough to produce sufficient draft to burn the fuel at the desired rate of combustion, and the sectional area large enough to carry off the gases produced at this rate. Chimneys should not be too high, as the rapid increase in cost of high stacks more than off-sets the increased efficiency. It is, therefore, good practice to figure on two or several stacks instead of one large one. The height required varies with the fuel. Wood requires the least, good soft coal comes next, while the finer sizes of anthracite require the greatest.

$$H.\ P. = 3.33\ (A - 0.6\sqrt{A}) \times \sqrt{H}$$

where

HP=horse-power of boilers served,
A=area of stack in square feet,
H=height of stack in feet.

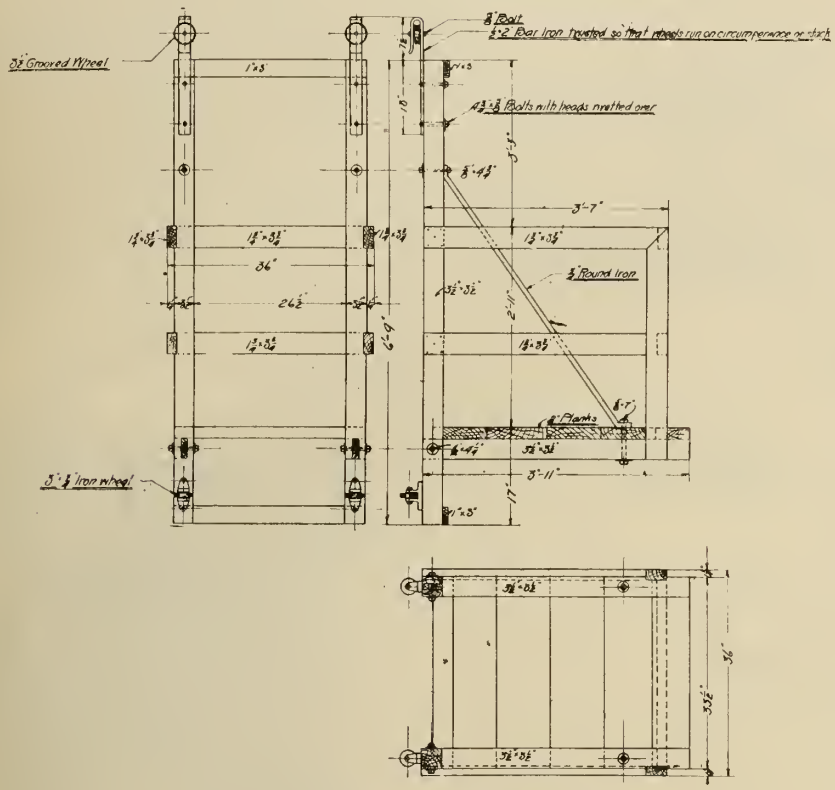

8" Grooved Wheel
8" Bolt
5"x2" Bar iron riveted so that wheels run on circumference of stack
4 1/2"x 3/8" Bolts with heads riveted over
1/2" Round iron
6" Plank
5" x 1/4" Iron wheel

Fig. 5.—Detail of Cage Used in Erection.

A formula which has been widely used and, when the assumptions upon which it is based and its limits, are fully understood, has given good practical results, is the following:

This formula, deduced by Kent, is based on the assumption that 5 pounds of coal are burned per horsepower per hour. In designing a stack, the height is usually assumed, the horsepower of the boilers known and the area computed from the above formula.

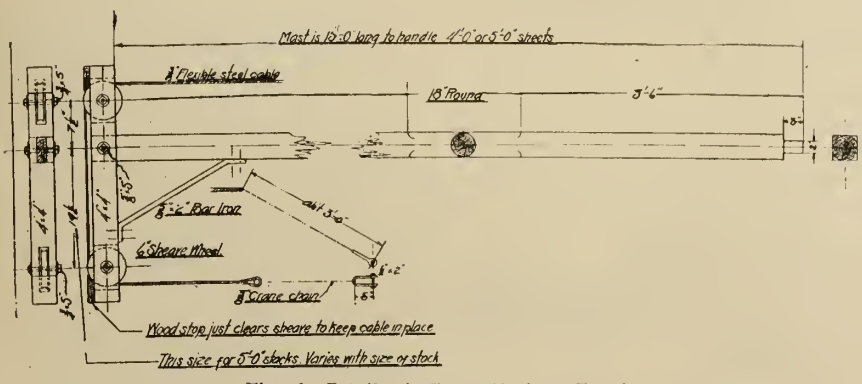
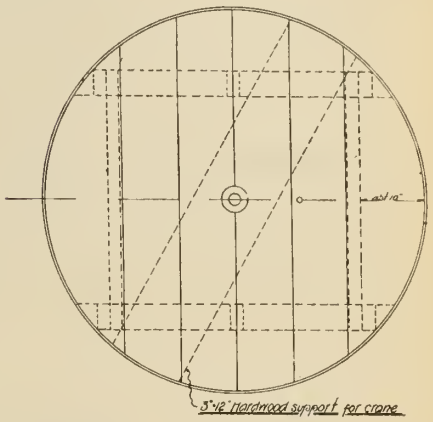

Mast is 18'-0" long to handle 4'-0" or 5'-0" sheets
3/4" Flexible steel cable
18" Round
5'-6"
5"x2" Bar iron
6" Sheave Wheel
3/4" Crane chain
Wood stop just clears sheave to keep cable in place
This size for 5'-0" stacks. Varies with size of stack

Fig. 6.—Detail of Crane Used in Erection.

## Construction (Guyed Stacks).

Steel stacks are of two kinds, guyed and self-supporting. Guyed stacks depend for their stability upon ropes or wires which are attached to the stack in two ways. One is to fasten them to a ring of angle iron about two-thirds of the height of the stack from the base. The other way is to pierce the chimney with four or more eye-bolts, provided with large washers inside the stack, and fasten the guys to these. The advantage of this latter way is that there is no shelf or ring to allow moisture to settle and corrode the metal. There should be at least four guys for a stack, the size of the rods being from ½-in. to ¾-in. diameter, depending on the size of the stack. If wires or cables are used their size should be the equivalent of these rods. The load supported by the guy ropes is that due to wind pressure, which is usually figured at 25 pounds per square foot of projected area. Stacks above 50 feet in height should have two sets of guys and there is sometimes three sets if the stack is very tall.



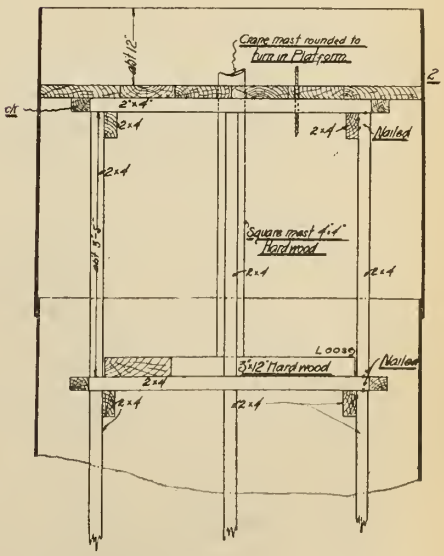




Fig. 7.—Scaffolding Used in Erection.

Since a guyed stack must only be strong enough to support its own weight, it is a cheap and light form to construct and is usually made in the form of a straight tube of in-and-out rings. In that case all of the sections can be rolled and riveted at the shop and after-

wards erected in position without the aid of expensive scaffolding. As guyed stacks are seldom much over 100 feet high, the thickness of plate is seldom over 3-16-in., and often No. 10, 12 or 14 gauge. These stacks, due to their lightness, are often placed right on the breechings of the boilers and never need very expensive nor substantial foundations.

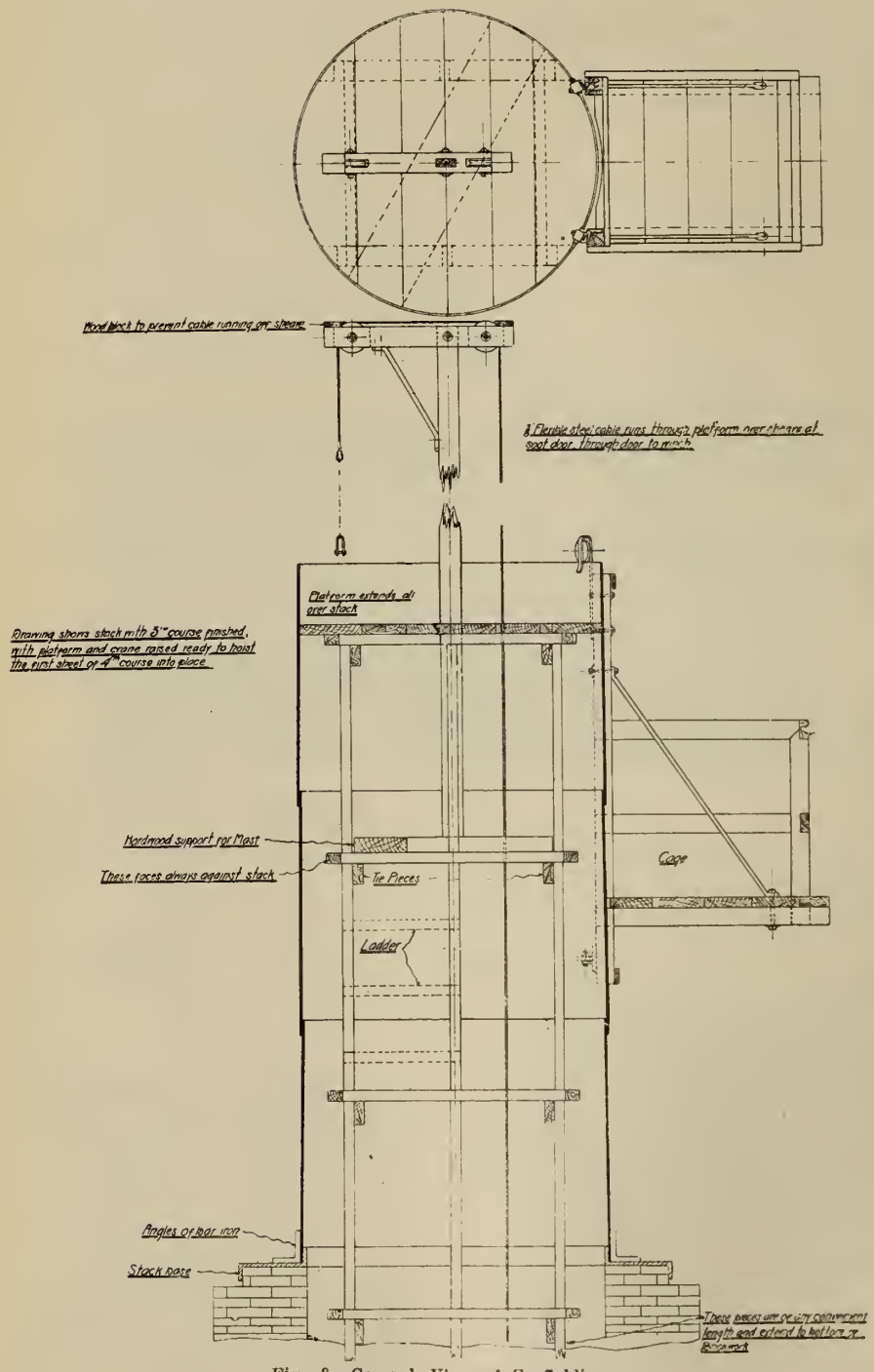

Wood block to prevent cable running off sheave
Platform extends all over stack
Drawing shows stack with 3" course finished, with platform and crane raised ready to hoist the first sheet of 4" course into place
Hardwood support for Mast
These faces always against stack
Tie Pieces
Cage
Ladder
Angles or bar iron
Stack base

Fig. 8.—General View of Scaffolding.

### Erection of Small Stacks.

These are shipped in one length, if not too long, or in sections, and riveted together into one piece at the site. A stout mast is set up as close to the stack base as possible. The length of this mast, is, of course, dependent on the length of the stack to be erected. It should be as long as half the stack, plus the height of the brickwork or breeching, plus six or seven feet to clear the tackle when the stack has been hoisted high enough to drop into place, plus one foot for the mast guys above the tackle. The mast guys should be made of rope that has been used and has most of the "stretch" out of it, so that the mast is not likely to sag when the weight of the stack comes upon it.

The stack is slung at the first row of rivets above its centre by an endless chain, which is just long enough to go round the stack and allow the hook of the hoisting cable to be hung to it. The stack is guided by a rope fastened to the bottom. Fig. 1 shows a small stack being erected in this manner, and Fig, 2 shows a simple, effective, two-man winch.

### Erection of Built-up Stacks.

The above method would not be practical for a large stack, say 6 feet by 100 feet. The plates for these are cut, punched and rolled at the shop, tried as for fit, marked, and sent to the site knocked down. Fig. 4 shows a portion of this stack being tried in the shop. It is made with three plates to a strake or course. The bottom plates are ¼-in., the midway plates 3-16-in., and the top plates ⅛-in. thick. Note the guard rings on the ladder which are part of the bars fastening the ladder to the stack.

Fig. 9.—Base of Self-Supporting Steel Stack.

Figs. 5, 6, 7, 8 show clearly the details of construction of the cage, mast and method of scaffolding that have have been effectively used by one company in erecting built-up stacks. The manner of erection is as follows: We will assume that the brick foundation of the stack has been completed and the cast iron stack base in position. The scaffolding is built up inside the brickwork to within about 12 ins. of the top and then the platform is laid loose upon it. The platform support (See Fig. 7) is made of 2x4-inch stuff, there being six uprights with two 2x4-inch pieces laid flat across the top. The two outside couples of uprights are connected by two pieces, also 2x4-inch. These latter should be about 10 inches from the circumference of the stack at their centres and should extend, on either side of the uprights, to the circumference. About 3 feet 6 or 8 inches below the platform the support for the

crane is laid across two tie pieces placed on the uprights for this purpose. The crane mast is stepped through the platform, rests with its shoulder on the 3x12-in. support, with its circular heel through the support. The cable, which is of ⅜-in. flexible steel, should be long enough to reach from the ground to 10 or 15 feet above the highest point of the stack when erected, thence to the bottom of the stack around a sheave at the soot door and thence through the door to the winch.

The first sheet is then hoisted into place and securely fastened to the base-plate by angles made out of ¾x3-inch bar iron. After the other sheets are hoisted into place they are drawn together by several bolts placed through the rivet holes. The cage is not used on the first course, so to facilitate the riveting a temporary scaffolding is erected from the roof of the building or from the ground. Care should be taken that this first course is square and plumb, as a small error at the bottom will be greatly magnified by the time the top course is in place.

The platform is now raised to within about 12 inches of the top of the first course and the crane support takes the place of the platform, resting on the two tie pieces from which the platform has just been taken. This crane support fits the circumference of the stack loosely, but is prevented from turning by the uprights which have been added to the scaffolding to support the platform in its new position.

The first sheet of the second course is now hoisted into place and fastened by bolts as before. The bolts in the centre are put in position by using a long pair of blacksmith's tongs or similar appliance. The second sheet is then put in place and the cage comes into use for the first time. This hangs from the top and rests against the last course erected, which has been made perfectly stable by riveting. The cage is easily moved around the stack by virtue of the wheels (see Fig. 5). The man with the "dolly-bar" has his place in the cage, the rivets are heated inside the stack, passed out to him and driven from the outside. The crane, not being needed while the riveting is in progress, is lowered until it rests on the platform by its cross-piece, thus leaving more hammer room.

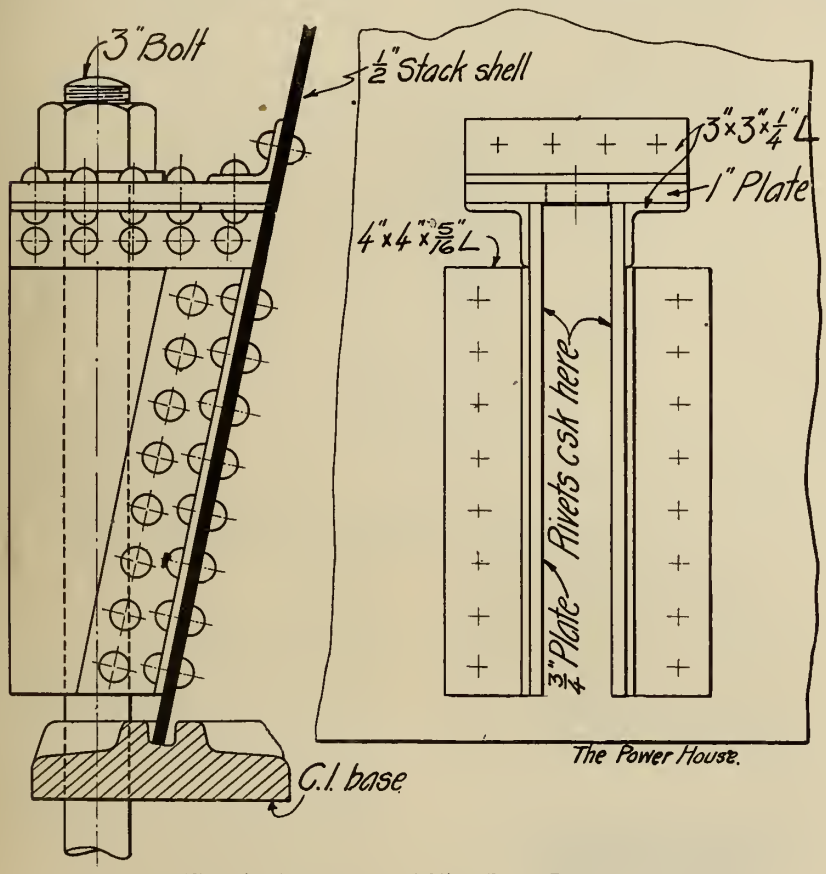



Fig. 10.—Bracket For Holding Down Bolts.

While the platform is being raised for the next course the forge, which would be in the way, is lifted into the cage until again required. When the first sheet of the third course is bolted into place, the cage is hung on that sheet while the rest of the course is being hoisted. This procedure takes place until the stack is finished. About thirty feet up temporary guy wires are called into use until the stack is finished and the permanent ones are in place.

### Self-Supporting Stacks.

These require somewhat more careful design than guyed stacks, for they must not only sustain their own weight and the weight of the lining, but must also withstand wind pressures. In building these they are given a taper of about 1-16-in. to the foot, and the bottom is made cone or bell-shaped to give added stability. Fig. 9 shows a bell-shaped base constructed of narrow vertical strips jointed with lap seams. This makes a very good base and forms a strong foundation for the rest of the stack. This base usually extends about 20 feet high. The diameter of the bottom is from 1-9 to 1-10 the height of the stack.

The stack rests on a base plate of cast iron, which is bolted to the foundation by its own foundation bolts. It is bad policy to fasten the stack to the base-plate, as is sometimes done, because of the unreliability of the iron. The best way is shown in Fig. 10. The holding-down bolts are fastened directly to the stack through steel brackets as shown. The strength of such brackets can be accurately figured and so relied upon.

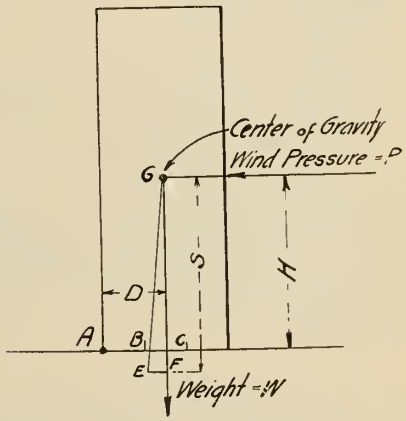



Fig. 11.—Diagram of Stability.

### Determining the Stability.

The stability of the stack depends directly upon its weight. The total wind pressure acting at the centre of gravity G (see Fig. 11) tends to upset the stack about the point A. Counter balancing this pressure is the weight of the stack also acting through the centre of gravity G. In other words, in order that the stack be perfectly stable, the couple P×H must be equal to or less than the couple W×D.

A graphical method of determining the stability of the stack is as follows: Lay out the stack to some convenient scale, find the total weight and wind pressure. The maximum wind pressure would be that of a gale of wind, or 50 pounds per square foot. As the stack is round, this would then be 25 pounds per square foot of projected area, and the total would be 25×diameter×height.

Divide the base into three parts, as at B and C (Fig. 11). Find centre of gravity G, which will be half way up the centre line of the stack. From G lay off the line GF, equal to the weight in some convenient scale; from F lay off FE at right angles to GF, and equal to the wind pressure in the same scale; join

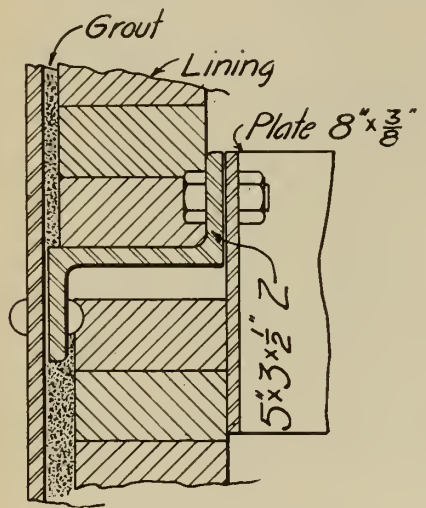



Fig. 12.—Method of Supporting Lining.

GE and if the line passes through the middle third, i.e., BC, the stack is stable.

**Determining the Strength.**

By this we mean the stress per lineal inch at any section of the stack. This stress at any section

$$= \frac{\text{moment due to wind pressure (in. lbs)}}{3.1416 \times (\text{diam. of section})^2 \div 4}$$

In finding the thickness of plate necessary to withstand this stress the efficiency of the horizontal joint is regarded and the formula is

$$T = \frac{10{,}000 \times \%}{S}$$

where

T=thickness in inches.

%=efficiency of horizontal joint.

S=stress per lineal inch

here 10,000 is taken as a safe fibre stress. These calculations should be made at several sections so as to be certain that the thickness of plate at these sections is such that the safe working stress of the material is not exceeded. As an example of the strength of a steel chimney, Kent in his Engineers' Pocket Book, takes a 125-foot iron chimney having an average diameter of 90 ins. The wind pressure on this will be $7.5 \times 125 \times 25$ or 23,437 pounds. In figuring the resistance offered to breaking, across the top of the foundation, the chimney is considered as a beam fixed at one end with a concentrated weight of 23,437 pounds applied at $(\frac{125}{2} \times 12)$ inches from the fixed end. The diameter of the base is 168 inches and the thickness of the plate is .25 inches, and the breaking stress of the iron is taken at 35,000 pounds per square inch.

Then the resistance offered to breaking is

$$\frac{3.14 \times 168^2 \times .25 \times 35{,}000}{(\frac{125}{2} \times 12) \times 4} = 258{,}486 \text{ or}$$

10.6 times the total wind force.

In figuring the resistance at any other section consider the stack as a beam fixed at that point and the total wind pressure as that against the stack ABOVE the point considered, acting at a point midway between the section under consideration and the top of the chimney.

**Stack Linings.**

The majority of self-supporting stacks are provided with lining of fire brick as a protection to the steel. These, however, do not continue right to the top, as the gases are sufficiently cool when near the top as to have no detrimental effect on the steel. Between the supports or connections to the shell, which occur every 40 or 50 feet, the lining is made sufficiently heavy as to be self-supporting. Fig. 12 shows one method of supporting the lining. A Z-bar ring is rivetted to the shell and to that is bolted a wide plate extending some 6 or 8 inches below the bar. The lining does

Fig. 13.—Frame of Spark Arrester on Top of Stack.

not come quite to the Z-bar to allow for expansion.

**Stack Accessories.**

Where the stack serves boilers fed with sawdust or light shavings as fuel—such as in the case of saw or planing mills, there is usually a spark-arrester provided. Fig. 13 shows the frame-work of such an arrester. This frame-work of light angle irons is covered with a wire mesh. The platform around the top facilitates the brushing and cleaning of the screen.

The top of a stack is sometimes flared out to form a cornice or cap for the sake of appearance. This cap is added and has nothing to do with the strength or stability of the stack, being made of very light plates. To stiffen the top of the chimney an angle iron or Z-bar is usually placed around it, while just below the cap is placed another Z-bar ring to provide means of attaching a painting scaffolding. The stack should be painted from the top and only the very best of fire paints used.

The flue opening to the stack should not be in the steel work if it is possible to avoid this position, as it materially weakens the stack. If it is absolutely necessary to have the flue above the foundation the opening should be very heavily reinforced. The best way is to have the opening in the foundation.

## HIGH VOLTAGE TEST.

With the purpose of studying enormously high voltages a short experimental transmission line has been built in Sweden which is adapted to operate at 500,000 volts. A special form of transformer is used to furnish this high electro-motive force. Circulating oil is used for insulation between the high and low tension windings. The line is supported on the suspended type of insulators which are hung at a distance of 11 feet apart. Tests of the surface discharge showed that a wire of 10 square millimeters (0.0155 square inch) cross section would discharge at 35,000 volts, of 20 square millimeters at 50,000 volts, of 100 square millimeters at 200,000 volts, and of 250 square millimeters at 390,000 volts. As the tension was raised to 480,000 volts, the noise grew very loud and sparks leaped from the insulators. At night the glow of the discharge could be seen two and a half miles away. —Scientific American.

## LIKES THE POWER HOUSE.

The MacLean Publishing Co.,
Toronto, Ont.

Gentlemen :—

I am just in receipt of cheque, and in enclosing receipt I may say that I did not expect this for the article. Please accept my thanks for same.

I think "The Power House" leads them all in the news engineers require. It is attractively gotten up and no engineer should be without it.

The advertising section of the paper is nicely arranged, and such handsome cuts are reproduced that it adds a great deal of value to the paper. It certainly should be a good investment for those who purchase the space.

I have been making a special study of the ignition apparatus in connection with gasoline engines, and may have something to say along that line in your valuable paper in the near future.

JOHN H. SLOAN.

# PRACTICAL ARTICLES BY OUR READERS

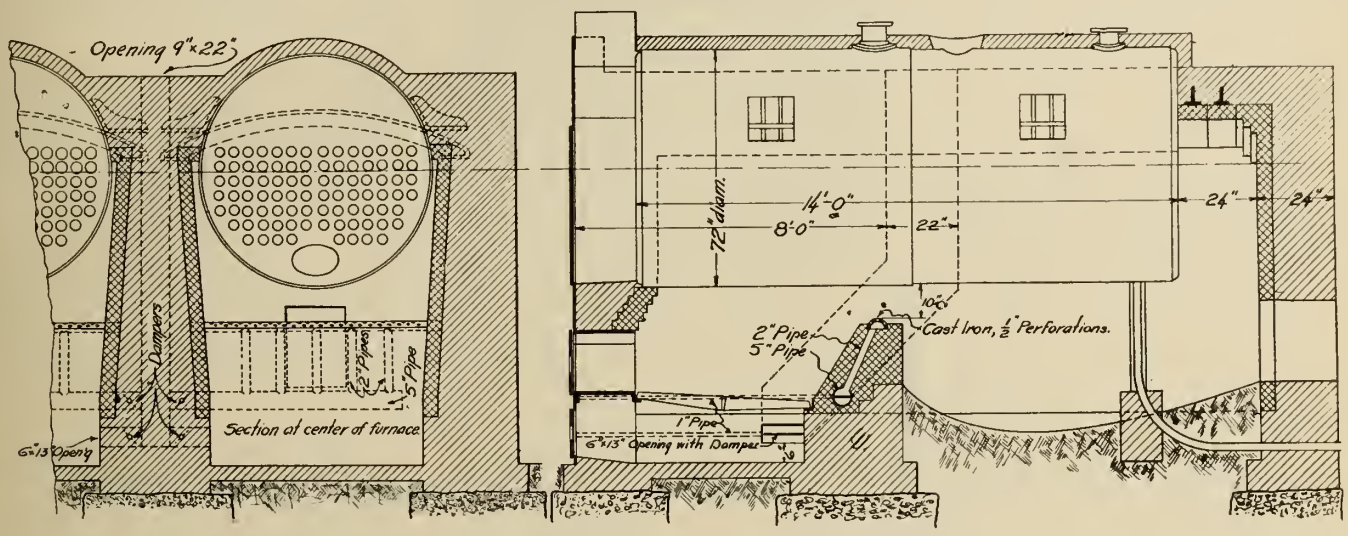
**Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.**

## A SMOKE PREVENTING DEVICE.

By H. de V.

The accompanying drawing shows a method employed to do away with the smoke nuisance. There are three boilers to this battery each 72 inches x 14 feet.

In building the settings a flue 9 in. x 22 in. was made between the boilers at a point 8 ft. from the front. This runs down straight and obliquely to within 6 inches of the bottom of the ash pit. Leading into each ash pit is a 6 in. x 13 in. opening provided with a damper.




A Smoke Preventing Device.

Through each bridge wall runs a 5 in. wrought iron pipe which also connects with the main flue. These pipes are also fitted with dampers.

On the top of each bridge wall and let into the fire brick is a heavy, half cylindrical cast iron pipe that runs across the whole length of the bridge wall and is let into the furnace walls on either side. This is perforated with numerous ½ in. holes. The opening inside this half round pipe is connected to the 5 inch main by 5-2 inch pipes. It will be noted that the bridge wall is flat and does not conform to the circumference of the boiler as is generally the case.

In firing a boiler of this type with the ordinary straight draft the back of the fire next the bridge wall, gets little draft and the position of the 6 x 13 opening in the ash pit, right under the back of the grates, gives this part of the fire an auxilliary draft of warmed air. The air coming from the perforations in the cast iron piece on top of the bridge wall is hot and giving to the escaping gases an additional amount of oxygen, the unburnt, suspended particles (smoke) are consumed in the back of the setting, thus adding to the available heat at this part and increasing the steaming facilities of the boilers besides eliminating the smoke.

The dampers in the different passages are operated from the front of the boilers by rods which pass through the one inch pipes shown in the side elevation. These boilers have been in operation for nearly two years and there has been little or no trouble from smoke. Of course it would hardly be feasable to use this arrangement on an old battery of boilers but if any of my confreres are preparing to superintend the erection of new settings, a consideration of this cheap and effective way of curtailing the smoke nuisance is worth while.

---

## SOME BOILER EXPERIENCES.

By R. Manly Orr.

Someone has said that "Honest confession is good for the soul," and I am going to make a confession, not so much in the hope that it will benefit me as that it will be helpful to some one who might make the mistake I did. About five years ago my firm put in a new 72x16 boiler, and with it came the style of back-arches shown in Fig. 1. Having had trouble with these before, owing to the fact that they continually keep creeping down the back head of the boiler till they partly covered the top row of flues, I decided that I would try and do something to prevent that occurrence in this setting.

There were eight of these cast iron segments with fire-brick keyed in between the projecting lugs at each end. I decided to let their top ends rest on an angle-iron which I placed at A and allowed to run out past the side of the boiler and into each wall.

The hole at B in the cast iron segments I thought was a very handy thing for raising and lowering the segments into place. Just a few days ago it became necessary for me to expand the top row of flues and when I came to try the expander I found that the angle iron under the weight upon it and being exposed directly to the great heat, had sagged in the centre till I could

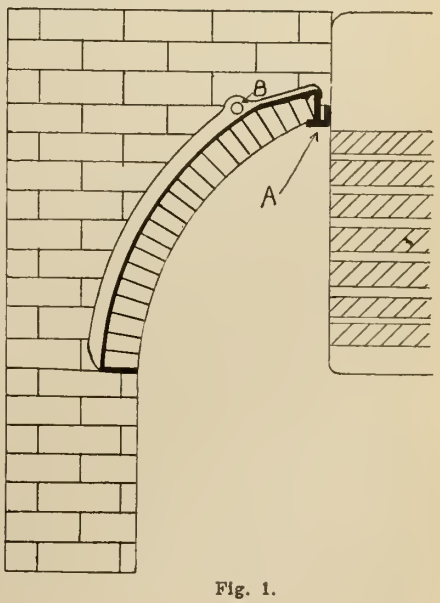



Fig. 1.

not work the expander in the middle of the row. Since this occurred I have

learned that these holes at B are to be used as in Fig. 2. Eight rods (c) made with a hook at one end and

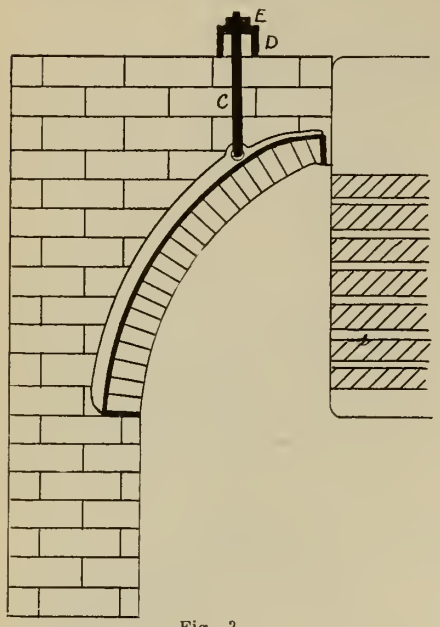



Fig. 2.

threaded at the other, carry a segment each and pass up through a double angle iron D which runs from wall to wall across the back of the boiler. By the nuts E adjustment is made and the segments cannot work down because their support is entirely away from the fire. I will now have to take out some of my brick work and have this change made, all because I did not know. I thought I did but I didn't.

At the time that this new boiler was being installed I allowed my other two boilers to run five weeks without washing out (three weeks being my regular practice). I did this because I was very busy with the new boiler and also because, when the new boiler would be started there would be better opportunity for cutting out these two old boilers. After the installation was completed and the new boiler cut in, I cut out one of the old ones. When I was raking the cinders off its grates, I was horrified to see on the belly of the boiler, immediately above the grates, a bag about 2½ inches deep by 13 inches wide and 17 inches long.

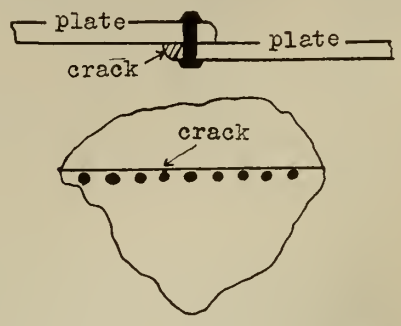



Fig. 4.—Sketch of Girth Seam Over Back of Grate.

Considerable scale was coming off these boilers at this time and a heap of it had gathered on this spot during the cooling down process of the night. When fired up in the morning with a quick fire the plate had heated to the point where it would stretch before the circulation was strong enough to set in motion the heap of scale and mud that was keeping the water from the plate. We decided to drive the bag up again and it is in the method used that I want to make my point. The old way is to put a small portable blacksmith's forge in through one of the fire doors, place it under the bag and when the plate is hot pull away the forge and drive up as long as the plate is workable, when the forge must be put in place again and the process repeated till the bag is all driven up.

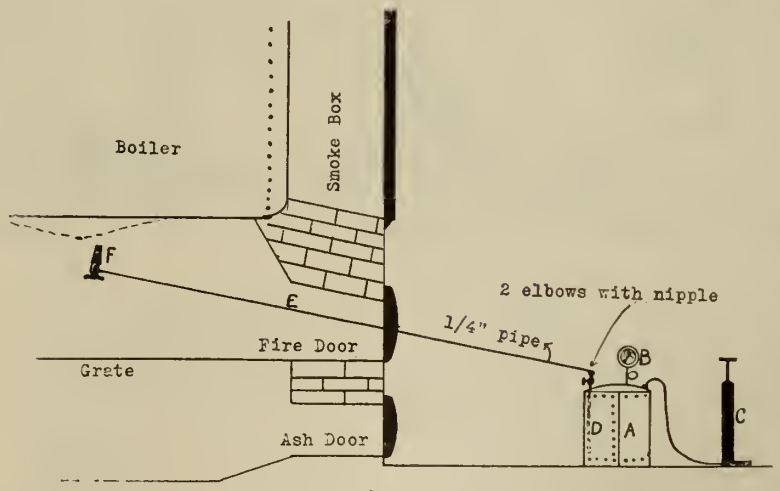



Fig. 3.—Heating Arrangement.

In this case we used a gasoline torch as shown in Fig. 3. A is a small tank tested to 200 lbs. per square inch and is supplied with a pressure guage B. The tank is a little more than half filled with gasoline and then by the bycle pump C a pressure of about 80 lbs. is raised in the air space. The gasoline is thus forced up the pipes D and E to the burner F which blows its flame up against the bottom of the boiler. As can be easily seen the pipe E will swing side ways or raise up and down and the tank will slide on the floor, so that when the spot to be driven is hot the burner is just swung to one side and pulled back to heat the next spot as quick as the hammer stops.

The driving should commence at the outside of the bag and be gradually worked into the centre by going round and round the bulge. The plate should be heated to a dull red and a short handled heavy hammer used with both hands. In closing let me ask a question. I have a crack in one of my boilers as shown in Fig. 4. How should it be repaired. I have been told of three different ways and am now waiting to see the boiler inspector.

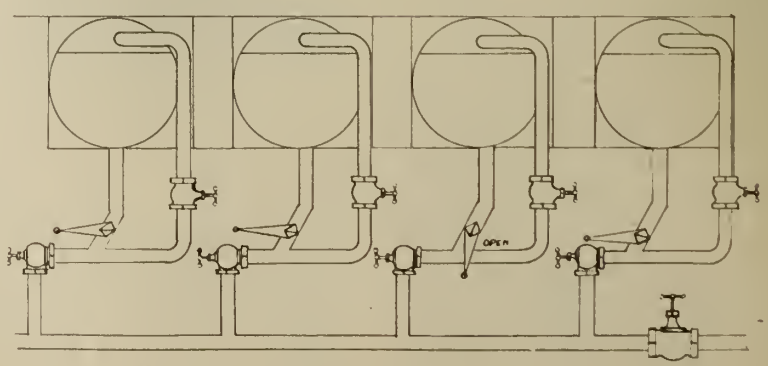
---

## UP-TO-DATE BLOW-DOWN.

By W. H. McIntyre.

This sketch shows an up-to-date blowdown and its uses in many ways. In order to use the idea there must be two boilers, for to put it into operation there must be two blow-downs. The boilers are connected as shown in the illustration.

The following is a good plan to use when a boiler is blocked with scale or mud between the boiler and the plug. The first thing, if the boilers are connected, is to cut out the one that is blocked up, at the header, and lower the steam down to half of one of the others. When this is done, go to the back of the boiler and open the plug



Up-to-date Blowdown.

and angle valve of the blocked boiler. Be sure to have the outlet valve closed.

When this is done, she is all ready to give her the steam or back shot. Steam from any one of the other boilers may be used. This is quite an improvement on the old system. The old way was to let the fire out, run the water out on the floor of the boiler room, get a pair of long boots and a raft, and tinker away with a hammer, piece of wire and all kinds of tools.

You may have a circulation in the pipe after you have blown down, by leaving the scum valve open, the plug valve open and the angle valve shut.

---

## FIRE BRICK IN THE BOILER SETTING—ITS USE AND ABUSE.

By C. N. Morgan.

The matter of the fire brick lining of the boiler setting is, in most cases, thought to be of minor importance. Of course, considered in its relative importance to the rest of the plant, this is true. Consequently there is not much care given to its selection, design, or maintenance as a general rule. Its constant need of repair and renewal is taken to be one of those necessary evils that have to be borne as well as possible, and that are not capable of much improvement.

With the present day keen competition, however, every cent that can be saved is important. If a fire-brick lining can be made to last somewhat longer than usual by any means whatever, then the question of fire-brick becomes at once worthy of careful attention.

A complete survey of the subject would open up too many different avenues of inquiry to be dealt with in the present article. For instance, we would have to take up the primary question of the form and arrangement of the setting as a whole. We would have to make comparisons between the old reliable settings and the various fancy, and more or less freakish, plans that are put forth from time to time; and this would lead directly into a discussion of smoke consuming, and baffling devices in all their infinite variety.

We would also have to go into the composition of the clays and other ingredients composing the brick, with reference to their fitness for special work. It would also be necessary to deal to some extent with the proper shape and size of the individual blocks. This would open up the controversy of the small brick with its liability to accident and disintegration, versus the large and solid shapes put forth by some manufacturers. The processes of instalation might also be touched upon, and lastly, the care that the brick should receive both before and after instalation.

This latter condition is the one that affects the life of the setting most vitally, assuming, of course, that a fair material is used and is properly erected. It is into this, therefore, that we shall go a little more deeply, touching on the others only as they directly affect the care or usage of the brick.

The proper time to begin to take care of fire-brick is the moment it arrives at the plant. Fire-brick is not as hard as granite. As a rule the most refractory grades are quite soft. In passing it might be well to state that the best brick to pick out for long life in a boiler furnace is one somewhat less heat resistent and with a good degree of hardness. The careful handling of the brick is not only desirable to prevent their total breakage, but also to prevent the edges and corners from being chipped off, for if they do not fit smoothly together with tight joints, the chinks must be filled with clay which provides a source of weakness.

It seems almost unnecessary to say that fire-brick should never be exposed to the weather, especially during the winter, yet there is many a failure with its consequent discrediting of good material which is due solely to carelessness or ignorance on this point. Summer rain is not necessarily harmful if the brick is completely dried later, but in the winter even moisture, which is absorbed from the air is liable to cause trouble. When this moisture or any other freezes and expands, if it does not destroy the brick at once, it causes cracks that will shorten the life of the brick very much. It is always best, therefore, to keep the brick as warm and dry as possible.

While it is not proposed to say much about the methods of instalation, there is at least one wrong method that most certainly tends to increase repairs. That is the use of too much fire clay. The brick should be laid up with only a thin fire clay grout and pressed tightly into position. Thus it is impossible for the clay to drop out from between them and allow the flame to find another point of attack against the surface of the brick. It also leaves openings for the insertion of those other destructive elements, the slice bar and the hoe. Of course, this danger is done away with if large blocks are used for lining the fire-box, instead of regular bricks.

The first firing up after the setting is finished is a time when much caution should be observed. One of the most important don'ts comes in right here. Don't fire up too soon. The lining should dry for several days if possible and then a very low fire kept on for a time so as to make the drying-out process complete. There has been many an engineer who wondered why his lining crumbled up so soon, who ought to lay it directly to too great haste in firing up after the brick was laid. High and constant heat will not destroy a fire-brick nearly as quick as sudden changes of temperature and this fact should be borne in mind when starting up or shutting down a boiler furnace.

Once the furnace is completed, the fire built, and the boiler started, the time for being careful is by no means over. It is just beginning. In fact, the lasting qualities of any brick may be said to depend mainly on the care and intelligence displayed by the fireman. There are forms of blocks on the market which are designed with particular reference to reducing the wear and tear from this cause to a minimum, but it is still true that one good strong-armed stoker can do more to demolish a furnace lining in ten minutes than the heat of the fires could in three months. In removing clinkers from the side walls, very often some of the brickwork is loosened and once this occurs, failure of the whole wall is not far off. Sometimes the door-jambs are used as a fulcrum for the slice bar and soon give way under the treatment. A simple way to avoid this is to build the jambs with sufficient flare so that the bar would rest against the door frame, but this is not always done.

Another practical thing to avoid is having part of the fire on the dead plate right under the boiler door arch. This arch then gets so extremely hot that when the door is opened, the cold air which rushes in has a most disastrous effect on it as a rule. It is better to enlarge the grate surface than to be patching up the boiler door arch every few months.

The above few hints are not offered in any spirit of criticism, or in the belief that most engineers are in need of much instruction on such a practical subject. They were merely set forth in the hope that they might be of interest to some who have not heretofore given the subject much attention, because of the proposition advanced; namely, that material economy can be gained by using care and discretion in the handling of the fire-brick furnace lining. This care can be exercised along three general lines, which, without trying to lay down set rules, are about as follows: First, remember that cold after extreme heat is the hardest test a good fire-brick can stand. Second, bear in mind that it readily absorbs moisture, which, by either freezing or being converted into steam, can easily destroy the block. Third, some reasonable care must be used in the handling, because at best they are much softer than ordinary brick and not meant to stand the abrasion which they sometimes are forced to undergo.

# Correspondence and Discussion on Previous Articles

Discussion is Welcome on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### QUESTION OF VACUUM.

The letter from "Trade Friend," page 31, May number, will prove interesting to a person who likes to see a lot of figures, but the practical man generally prefers a straight answer to a question. Theory is all right under certain conditions and I believe it is almost impossible for the average stationary engineer to make any headway these days without a certain amount of technical knowledge, but I say, let us have practical information, gained by practical experience when possible.

"Trade Friend" tells us that in practical work a lift of 7 feet 1½ inches will give satisfactory results with the average pump. I have installed at least a couple of hundred hand and power pumps, and I have found that the average pump will not give satisfactory results with a greater lift than 25 feet, and in some cases a suction pipe air chamber was necessary even at this height; especially is this so when several turns or bends are in the suction pipe. I installed a hand pump some time ago with a 26-foot lift, and it required the whole weight of a man thrown on the handle at each stroke to get even a small supply of water. I lowered the pump a couple of feet, and it worked quite easy.

James E. Noble.

---

### CARE OF BOILERS.

In the March Power House is an article on the care of boilers, in which the claim is made that a boiler cannot be washed in one day. I think the claim is correct. At any rate, I can't do it in a day. I have four boilers, three of which are in constant use. The boiler to be washed is cut out Saturday or Sunday and allowed to stand until there is no steam on, then blown down, opened and washed at once with the hose from the manhole on top to remove mud before it bakes.

When cool enough to enter, it is washed thoroughly from the inside and both ends. Before closing it up, from one-half to three-quarters gal. of coal oil is poured in, so that as the water rises the oil comes in contact with the surfaces of the tubes and shell.

The feed water enters at the top of the boiler and the end of the feed pipe is in a cast iron pan on top of the tubes. With the exception of about a foot around the pan the scale on the tubes is about as thick as a sheet of the paper you are reading, and large areas have absolutely no scale.

The use of coal oil is not advised for those whose hearts or nerves are weak, because if the boilers are dirty before using it, the amount of scale thrown down is likely to give the user a shock which might be fatal. It surprised me the first time I used it.

It is well to not let the boiler go too long after using the coal oil before opening and cleaning as a bag might result.

An advantage in letting the boiler stand for a day after the first washing after opening, is that the scale becomes loosened, perhaps from unequal contraction, and is easily knocked of with the hose. I use a boiler compound, also, feeding a small quantity daily.

Another battery of boilers that I can remember were treated differently. The boiler to be washed was cut out Saturday evening. A gang of men came in Sunday morning, blew the boiler down and had it ready for steam Sunday evening. The boiler man's report was always to the effect the boiler was clean and everything in good condition. Yet when I took charge of the boilers and examined them, I found that the nest of tubes on the feed pipe side were laid solid in scale. The first attempt to remove the scale, which was made with hammer and chisel, resulted in holes being punched in the tubes. Then a saw was used vertically and horizontally between the tubes until daylight could be seen through them. They were bad.

MAC.

---

### FRIENDLY CRITICISM.

Mr. W. A. Crockett in his Course of Lessons is not careful to state whether it is gage pressures or absolute pressures he is referring to and consequently we have to look up our steam tables to see what is what. That is undoubtedly good exercise but it is no royal road.

For instance he says that water in a boiler under 250 lbs pressure of steam is at a temperature of 401 deg. F. An examination of the steam table shows that absolute pressure is meant. Then he says: "if you boil water under a pressure of 5 atmospheres or 75 lbs. pressure the sensible heat is 306 deg. F., but the latent heat has decreased by the same number of heat units that the boiling point has increased so that the total is the same in all cases."

Absolute pressure is evidently meant here; as the sensible heat, or rather temperature, is 307.4 deg. for this pressure, but the latent heat has not decreased by the same number of heat units or temperature that the boiling point has increas?d and the total heat is not the same for any two cases.

For instance take two pressures, say, zero, and 200.3 lbs. gage pressure, and we have the following:

| | Temp. above 32 F. | Total heat. | Latent heat. |
|---|---|---|---|
| At zero gage pressure .... | 212 F. | 1146.6 | 965.7 |
| At 200.3 gage pressnre .... | 387.7 | 1200.2 | 838.9 |

We see that the boiling point has risen 175.7 deg., the latent heat has decreased 126.8 heat units and the total heat has increased 53.6 heat units.

An error that a great many of us make is to confuse temperature with heat units. Temperature is a comparative term and is used in indicating the relative or different degrees of coldness or warmness.

A heat unit is a definite term and indicates a certain quantity of heat. There are different kinds of heat units. The British heat unit or British thermal unit, or B.t.u. is the amount of heat required to raise 1 lb. of water from 62 deg. to 63 deg. F. Above 63 deg. it requires slightly more than 1 B.t.u. to raise the temperature of 1 lb. of water 1 deg. and below 62 deg. slightly less.

A thermal unit is the amount of heat required to raise 1 lb. of water 1 deg. centigrade. Another name for thermal unit is pound calorie. A calorie, which is another kind of heat unit, is the amount of heat required to raise 1 kilogram of water 1 deg. centigrade. The calorie is part of the French or metric system.

The British thermal unit is the English system and the pound calorie is a sort of a cross. 1 calorie equals 3.96 B.t.u. and 1 pound calorie equals 1.8 B.t.u.

MAC.

---

The council of the Institution of Electrical Engineers of London, England, have appointed Lawford Grant, Montreal, Canadian representative of British Insulated & Helsby Cables, Ltd., honorary secretary and treasurer for Canada, in succession to Prof. P. B. Owens, late of McGill University.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

## IMPROVED BEAVER DIE STOCK.

The Borden-Canadian Co. have placed on the market from time to time various designs of pipe threading tools to suit the work of the steamfitter and plumber. Their latest tool placed on the market is a greatly improved No. 2 Beaver Die Stock, the new one being known as their No. 20. The improvements are very important from a cost saving standpoint and in design.

The feature of all the Beaver die stocks is the rapidity of changing from one size to another by the simple shifting of a lever. Should a pipe split when threading, the die can be released by shifting the lever. One set of dies is used for threading four sizes, and by a simple mechanical arrangement they automatically recede while threading, to

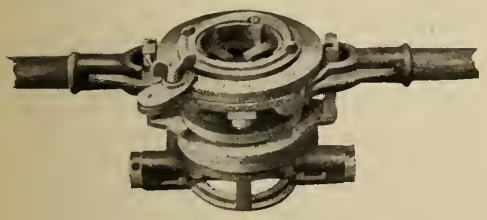


Fig. 1.—Front View No. 20 Die Stock.

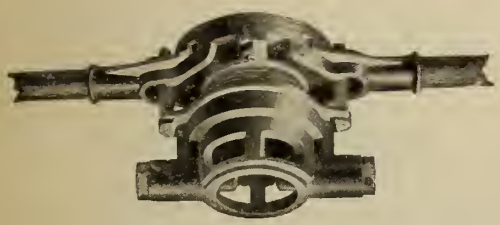


Fig. 2.—Back View.

form a tapered thread of $\frac{3}{4}$'' to the foot. The first tooth of the chaser takes a roughing cut, each succeeding tooth cuts a little deeper and the last tooth makes a finishing cut, forming an especially smooth thread. The whole arrangement is very complete and the die is always ready for the four sizes of pipe by a simple change of the cam, without time being lost changing dies or bushings.

Fig. 1 shows a front view of the improved die stock, and Fig. 2 is a rear view. It cuts right hand threads 1'', $1\frac{1}{4}$'', $1\frac{1}{2}$'' and 2''. The net weight is 19 lbs.

The principal new feature of this die stock is shown in Fig. 3. This view shows the rear barrel and feed ring, removed from the die stock. With the old No. 2 and other stocks of similar construction, when this part of the stock wears out, as it will in time, it could not be replaced. That this part may now be replaced is a very important improvement. The lead screw is necessary if thin chasers are used. The advantage

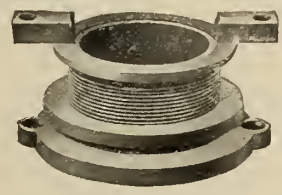


Fig. 3.—Rear Barrel and Feed Ring.

in using thin chasers is to reduce friction. A stock with thin chaser pulls easier than a wide chaser.

The thicker the chaser the more power it takes to cut a thread and when these thick dies get dull, it is hard to start the die on the pipe. A lead screw overcomes this but in time they will naturally wear out. Provision is made in the No. 20 die stock whereby these parts can be replaced.

The main part of the Beaver die stock is malleable. The lead screws and corresponding parts are reinforced and strongly made, neat in design and accurately fitted to the frame.

No bushings are necessary, but if a customer wishes to have them they can be supplied. The jaws are made of tool steel and milled to hold the various sizes of pipe and are concave and center the pipe exactly. The opening is large enough to take in a 2'' coupling for making short nipples.

The whole stock is well designed, the parts are accessable, and may be replaced by the owner in a few minutes. Beaver die stocks in six sizes, ranging from $\frac{1}{4}$ inch to 6 inch, including the new No. 20 die stock, are manufactured and sold by the Borden-Canadian Co., 66 Richmond St., East, Toronto

---

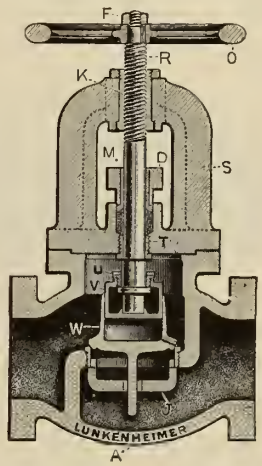
## NON-RETURN BOILER STOP VALVE

The neeessity for a reliable non-return stop valve on each boiler when several are operated together, is now universally reeognized, and in some eountries their installation is required by law.

When several boilers are eonneeted to a common header, if a tube is blown out or a fitting ruptured, the steam from the battery of boilers will rush into the header and discharge through the boiler which is disabled. The difficulty of elosing a stop valve in the event of sueh an aecident is apparent. The valve illustrated is designed to overeome this danger and is intended to be placed between the boiler and header.

The non-return stop valve illustrated on a boiler prevents steam being turned into it when it has been eut out for cleaning or repairs, for the reason that the valve cannot be opened by hand. It can, however, be closed by hand the same as any other stop valve.

The None-Return Valves are made of good materials, and the areas are unusually large and free. The internal dashpot and piston prevents chattering of the dise. All wearing parts are




Non-Return Boiler Stop Valve.

made of bronze and the gland and stuffing-box are broze bushed. For superheated steam work these valves are made of "Puddled" Semi-steel with nickel trimmings and nickel-steel stems.

The valves are made in sizes from 4 to 10 inehes inclusive, with screw or flange ends, by the Lunkenheimer Co., Cineinnati.

---

## POTATO SCALE POWDER BOILER CLEANSER.

The potato scale compound is a preparation for removing the scale from steam boilers. It will neutralize acid and mineral water and remove scale without atttacking the boiler shell. The action of the cleanser is to break up the crys-

talline character and capacity to solidify. solidify.

The composition of the cleanser depends on the water used in the boiler. A sample scale is analyzed and the proper powder sent to remove that particular scale.

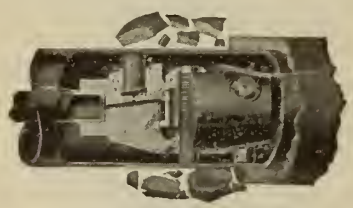
In using this powder dissolve 1 to 6 pounds in a pail of hot water and inject or pump into the boiler or throw it in through the man hole. It can also be used in the feed water. When the scale dissolves, the water becomes muddy and is shown by the gange glass. When this has taken place blow down each morning about half an inch or an inch before firing up. When the water comes out clear the dissolved scale has been removed.

C. C. Snowdon, Box 1384, Calgary, Alta., is the sole agent for Canada for potato powder boiler scale cleaner.

## TUBE CLEANERS.

The rapidly vibrating knocker shown in Fig. 1 is for clearing tubes of a return tubular boiler. It is operated from outside the boiler by simply connecting the device with ordinary steam pipe and hose to a suitable steam or air supply.

The Torpedo cleaner, Fig. 1, has a



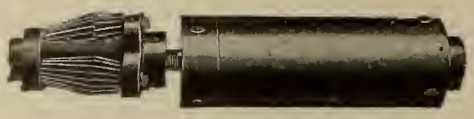
Torpedo Fire Tube Cleaner.

rapidly oscillating piston which can be operated by steam or compressed air. The reciprocation piston with its vibrator subjects the tube to an exceedingly rapid vibration. The cleaner is passed through the tube from end to end and on account of the non-elastic character of the scale formation the latter is unable to retain its position on the outside of the tube and falls to the bottom of the boiler and is there raked out through the manhole. The cleaner is held centrally in the tube by centering lugs which are automatically forced out by the steam or compressed air used.

For water tube boilers where the scale forms on the interior surfaces of the tubes the "Demon" has been designed in two types, one for the straight and one for the curved tube boilers. The motor consists primarily of a body and a main shaft located centrally. Hinged longitudinally with the shafts are three pistons which are so arranged that the water automatically throws each one in turn in its working position, and each piston folds in when the water has rotated the piston to the exhaust port.

The pistons are arranged parallel with the tube and a large piston area can be employed upon which the hydrostatic pressure acts directly.

A non-yielding cutter head is used. The cutter head as a whole, is set to the



Demon Straight Tube Cleaner.

net inside diameter that the tubes should be when clean, consequently the head must remove all scale before the cleaner can be passed through. Provision is made for the adjustment of the cutters on account of wear or for the variations in the tubes themselves. The manufacturers of the above cleaners are the General Specialty Co., 891 Niagara St., Buffalo, N.Y.

## POINTS ABOUT FEED WATER HEATERS.

Protection against oil getting into the boilers is a prime factor of ultimate power plant economy and safety wherever heat from the exhaust steam is utilized for preheating the feed water. If oil-laden exhaust comes into direct contact with the supply water, the latter is bound to be more or less contaminated by the oil particles, which, if not removed, collect on and ruin the boiler heating surfaces. The seriousness of this may be inferred from the fact that in many large plants running condensing, the water of condensation and its contained heat are thrown away just to avoid letting the oil from this condensation get to the boilers.

This fear of oil has influenced many an engineer to equip his plant with a closed rather than open heater, regardless of price difference. In the former, the exhaust steam cannot mingle with the feed water, and hence there is no danger of contaminating the water supply with impurities from the steam. The brass tubes of a closed heater, if kept clean, offer practically no resistance to the transfer of heat. Even if they did, there would be no loss of efficiency in the closed heater that would make a detrimental comparison with the performance of an open heater, for in any heater only a small part of the exhaust steam is required to heat all the feed water from supply temperature to about that of the exhaust.

It is a fair assumption that protection from oil is as important a requirement as is the heating efficiency. These requirements were kept in mind in designing the Goubert "Multipass" Heater, recently introduced and made in sizes of from 50 to 5,000 H.P. by The Goubert Mfg. Co., New York. This apparatus is guaranteed by the manufacturers to heat feed water from ordinary temperature to within 10 degrees of the temperature of the exhaust steam.

Referring to the illustration, the Goubert Heater consists essentially of two cast iron water chambers connected together by a cluster of small straight brass tubes, which in turn are enclosed within a cylindrical cast iron shell extending from one water chamber to the other. The ends of the tubes are rolled into steel tube plates in the same manner as boiler tubes are rolled into the manifold. The cast iron shell surrounding the tubes merely provides an envelope for the exhaust steam, and is of larger diameter than the water chambers, to form an annular belt from which the steam may enter among the tubes from all directions. The exhaust steam enters the shell by the upper opening shown at the right, and what does not condense passes out the lower opening. That which is condensed on the tubes flows to the bottom of the shell and passes out through a drip pipe. The oil or grease in the steam is removed and passes off with the drip, leaving the remainder of the exhaust steam in good condition for heat-

Feed Water Heaters.

ing systems and other purposes where live steam is sometimes used.

In some closed heaters, the steam is made to circulate inside the tubes, while the water is in the shell. In either case the water is forced by the pump through the apparatus as though it were but a part of the feed pipe. In the Goubert Heater, the water is within the tubes so that the scale may be easily removed. By removing the top chamber the tube interiors can be examined and cleaned out. Any sediment which falls either during cleaning or operation, goes down into the bottom of the lower water chamber from which it may be drawn out through the bottom blow-off openings.

There are baffles so placed in upper and lower chambers that the feed water entering at the bottom must travel back and forth through several sets of tubes, and be subjected to the heat of the steam several times before it can reach the outlet at the top. In a 700-H.P. Goubert Multipass Heater, for instance, (handling 21,000 gallons of water per hour) there are 100 tubes each one-inch in diameter and over seven feet long. The feed water must travel five times the length of these tubes in the path of the steam.

The Goubert Heater is provided with an expansion joint between the upper chamber and the shell. The upper chamber is supported entirely by the tubes and left free to move up and down. The expansion joint is fitted with a flexible ring gasket composed of layers of

Turbo Blower.

soft copper and special packing with wire interwoven. The inner edge is clamped between the shell and an annular ring. The only purpose of this gasket is to prevent steam from escaping into the room, and is subjected to no other pressure than atmospheric.

The vertical construction is preferable, but for installation where there is not sufficient head room, as in the cellars of city buildings, the horizontal heater shown in the illustration can be used. This has the same essential features as the vertical type, and is also useful in connection with condensing engines. If it is desired to suspend the horizontal heater from the ceiling, the feet may be replaced by straps lugs or bolts.

---

## TURBO-BLOWER.

The Turbo-Blower, illustrated in the cut herewith, is designed to enable the engineer to obtain the greatest boiler efficiency and providing the draft at a low cost of power.

In construction it consists of a combination of a fan and steam turbine. The turbine constitutes the hub of a fan of the propeller type, and as around the hub is the least effective part, no efficiency of the fan is sacrificed.

The turbine is of the single stage impulse type, with the steam issuing from the nozzles acting directly on the buckets which are attached to the fan and located inside the hub. Being very small it consumes only a very small fraction of the steam generated, and as it is in the hub of the machine it is entirely protected against dust, dirt and ashes.

The Turbo-Blower Co. has issued a catalogue giving a detailed description of the apparatus and illustrating its application to boilers of different types. The machine may be installed on any type of boiler and can be placed in the front, the side or the rear according to conditions. It is simple in construction and designed to stand the rough usage of the boiler room. It requires no attention other than occasionally filling the oil cup. It may be controlled by hand, or if connected with a damper or other regulator, its operation becomes entirely automatic.

The Turbo-Blower was recently put on the market by the Turbo-Blower Co., 30 Church St., New York City.

---

## BOILER COMPOUND FEEDER.

The tank holds two gallons and is made seamless, of heavy pressed steel, with cover, and fitted with finely perforated steel false bottom, which acts as a strainer.

The sight feed is of cast iron, with brass rings to hold glasses in place, which are 2 5-16 inches diameter, ¼ inch thick, of best window plate.

The injector is of fine grey iron, with brass nozzles. Valves, air cocks, check valve, etc., are of good quality.

The following are the directions for setting the feeder: Always attach this style feeder to both sides of boiler feed pump. That is: to both suction and discharge lines of pump. Connect the angle valve side of feeder to discharge lines and the side with check valve, to the suction line.

After feeder is properly set up close valve under tank and fill tank with compound sufficiently diluted to make it drop freely. Open angle valve and adjust so no water will back up into sight feed glass.

Now open valve under tank just

Boiler Compound Feeder.

enough to give a steady drop by drop feed, except for large boiler capacity requiring a small stream.

Lower air cock is intended only for drawing water out of sight feed chamber, should it fill up. The injector nozzles in the tee are made adjustable to suit conditions governed by pressure on pump or feed line.

The feeder is placed on the market by the Hygienic Laboratories, 11 Colborne St., Toronto.

---

## FOR THE JULY ISSUE.

Three articles held over for the July issue are "Smokeless Combustion of Coal in Boiler Plants," "Induced Draft," and "Features and Capacities of Safety Valves." These are excellent articles and should be read with great interest.

---

## DOES IT PLEASE YOU?

If this issue of The Power House pleases you let us know. We are always glad to hear from our friends with comments and suggestions. Write us to-day.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*

*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe 933-935 Monadnock Block
NEW YORK - R. B. Huestis 622-624 Tribune Bldg. Phone 4535 Beekman

**FRANCE**
PARIS - Agence Havas 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wol Orell Fussli & Co

Cable Address:

Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II JUNE, 1909 No. 6


## UNIFORM BOILER LAW.

That the machinery of governments is slow to revolve is seen in the securing of uniform laws governing the construction of boilers. As it is at present, a boiler built for one province will not be acceptable for one of the other provinces and the effect is to stop or at least curtail the business carried on between provinces, and this appears to us to be striking a blow at the British North America Act of 1867. One of the important benefits of that Act was to remove the barriers preventing the various provinces trading with each other. The Canadian Manufacturers' Association have carefully considered the question from a wide viewpoint, having considered it from the standpoint of the manufacturer, the engineer, the purchaser and the public generally.

A review of the question of boiler regulations and the steps being taken to secure uniform legislation will no doubt be of interest.

The situation at present is that each province or city has its own boiler regulations, each differing from the other. This is extremely inconvenient for manufacturers who sell boilers in all the provinces. How the boiler is made, depends upon the province in which it is to be used; and the necessary formalities to be gone through also depend upon that. Manufacturers cannot stock boilers to advantage, except a separate stock for each province, for which there is not the market.

This applies only to land and stationary boilers, and not to marine boilers, as there is a Dominion Government Marine Boiler Law which governs all over Canada the manufacture and use of marine boilers.

An Act such as the Manufacturers' Association proposes would protect the purchaser, for he would buy it under guarantee, irrespective of the province in which it is to be used. The reputable manufacturer does not want to build boilers that are not safe, but a boiler that is safe for one province should be safe for another. The capacity of material to resist rupture is the same whether the boiler is used in Nova Scotia, Ontario, Alberta or any of the other provinces. There are no geographical bounds to the laws of statics.

The present laws are not fair to the manufacturer, for different specifications are required for a boiler for use in Manitoba and British Columbia or Ontario or one of the other provinces. The direct result of uniform laws would be to lessen the expense of manufacturing, and increase the care in construction. Workmen would become more proficient building boilers under one set of specifications, and the users would be sure of the best possible boiler for the money invested.

In order that the question might be carefully considered the engine and boiler section of the C. M. A. appointed a committee of experts, consisting of Joseph Fux, Waterous Engine Works, Brantford; A. W. Spotton, Goldie & McCulloch Co., Galt; F. Raney, John Inglis Sons' Co., Toronto, and G. H. Todd, Polson Iron Works. This committee has done its work under Frank E. Leonard, Chairman of the Engine and Boiler Section of the C.M.A.

In April 1908 this committee made its first report, a draft of which was sent by the C.M.A. to all boiler manufacturers and dealers, asking for suggestions and criticisms. A number were received, and the committee drew up a second report in which these suggestions and criticisms were considered.

Mr. Leonard presented the report of the committee to the C.M.A. in Montreal last year and at a meeting of the Boiler and Engine Section a committee consisting of John J. Moire, Polson Iron Works, Toronto; William Inglis, John Inglis Co., Toronto, and Mr. Jenckes, Jenckes Machine Co., St. Catharines, were appointed to further consider the question and it is now in the hands of the parliamentary committee.

British Columbia has a good law, Alberta's new law is very good but contains differences from the B.C. law. In Ontario boilers are built according to insurance specifications and many are not inspected, a condition of affairs not fair to users and a state of affairs that boiler manufacturers wish to remedy. Such differences of opinion and practice as are manifested should be easily reconcilable and manufacturers are anxious for greater restrictions, providing they be uniform, from coast to coast. Let us treat all users and manufacturers alike. Let us carry out the spirit of the British North America Act by a uniform boiler construction law and we will protect, to a greater extent, life and property, facilitate the manufacture of boilers and give the user a guaranteed well constructed boiler.

## THE INSPECTION OF BOILERS.

Explosions of boilers are constantly occurring and are attended in almost every instance with the loss of life and property. It may not be possible to wholly eliminate the explosions of high pressure steam boilers but the question certainly requires more careful consideration. In the United States last year there were 470 explosions of stationary and portable boilers and about the same number in 1907. The number of persons killed in the two years was 581, not to mention anything of the large loss of property or nearly 700 persons in addition each year who were injured. The same thing is happening in Canada, explosions due in a great many cases in both countries to insufficient legislation.

With a properly built boiler, carefully inspected and the exercise of a reasonable amount of care in operation, there is little occasion for any explosions whatever. The lap seam boiler and the lack of inspection has no doubt been the cause of a great number of explosions and the whole question should be carefully considered by the Dominion Government. We have the Factories' Act, but that doesn't go far enough. All boilers should be inspected. Each province has some legislation but there is very little uniformity and there are a number of boilers never inspected. Then second hand boilers are being sold, that should be in the scrap pile. The only way to stop this business of endangering lives and property is to have a general law covering the inspection of all classes of boilers.

The question might be asked, "How best can boiler inspection be carried out?" We will have more to say on that part of the question in an early issue. Some engineers and manufacturers are in favor of government inspectors but there is sometimes an inclination on the part of a government to appoint to positions, friends of the party instead of competent men. The plan followed by the Board of Trade in England will probably be the best example to follow, i.e., make the proprietor of the boiler responsible for any loss due to boiler explosions, whether life or property, and make the fine heavy enough to ensure safety.

The proper inspection of boilers is a question of interest to every engineer and there should be an organized movement on their part and on the part of the public generally, to secure strict legislation in regard to inspection. The government ought to be made to see that a needless waste of life and property can be eliminated by the enactment of proper boiler inspection legislation.

## STICK-TO-IT-IVENESS.

There is no place in this world for the man who says the world owes him a living and then sits down in a rocking chair and sings, "The Lord will provide." The boy who cannot master fractions, the man who blisters his hands and then rests on his oars, is a quitter. We have to get over stubbed toes and sore fingers if we are to fill our place in life.

Too many are looking for an easy job and a fat salary and complaining because they cannot get it. The quitter is like a broken rail on the road or a broken cogwheel. He is a time killer, using up the patience of others and is dissatisfied with himself.

The boy who becomes a man never shirked his work. He carried his share of the responsibility in spite of "headache," or blistered hands. It is the boy who by sheer grit, sticks to the work in hand, who develops into one who accomplishes things. And he does it in spite of bad crops, high water or the measles. He knows no failure, and his success is due to the habit of finishing the thing he undertakes. The one who fails is a quitter. The successful man cultivates the quality of stick-to-it-iveness.

## JUST A REMINDER.

A gentleman with many years' experience on the advertising field remarked recently that Canadians, when writing to firms in reply to advertisements seldom made reference to the publications in which they had seen them. We do not know how far this applies to readers of The Power House. Some at least do mention this paper when they are answering advertisements; possibly there are some that do not.

The Power House has a great many friends in Canada, and the publishers would appreciate it very much if when writing to firms for catalogues or machinery advertised in this paper, they would give this paper credit. The advertisers would appreciate it and The Power House certainly would.

One of the main purposes of The Power House is to further the interests of power, to make the various classes of machinery better known to proprietors and engineers, to educate engineers to the best methods for use in the power plant and to acquaint them with the latest and most improved machinery placed on the market and the modern practise. One good turn deserves another, and our readers will be doing a good turn, if, when writing for catalogues or in reply to advertisements, they mention The Power House. Try it with this issue.

## TOPICS OF THE MONTH.

The Province of Alberta has issued regulations governing the construction and inspection of boilers. These are reprinted in full in this issue. On the whole they are very good though in the case of some boilers some changes are necessary. Large and influential deputations of manufacturers of threshing outfits have prevailed upon the Alberta government to make changes in the regulations referring to the class of boiler used for that work. Changes will be made at once. The changes will permit a boiler more accessable for cleaning being constructed.

* * *

Nickel steel will be used in the construction of the new Quebec bridge. This has a greater strength than the carbon steel used in the first structure. The new bridge will have a span almost as great as the 1,800-foot span of the first bridge. This means that the present piers, which cost a million and a half dollars, will be made use of. The carrying capacity will be considerably greater than was designed for the first. The new bridge will carry any load that can be transported over 80-pound rails. The height of the bridge has been definitely fixed at 150 feet above water at high tide.

* * *

As an instance of development in Western Canada, it is estimated that $85,000,000 will be spent in construction work alone during the present year. The work under construction by the C.P.R. will be $20,000,000, Great Northern $15,000,000, C.N.R. $11,000,000 and the G.T.P. $11,000,000. The industrial life of Canada is steadily forging forward and the railways are only keeping pace with the development of the country. The twentieth century is the century of Canada.

### IMPROVED DIAMOND GRATE.

The Diamond Grate Bar Co., have placed on the market an improved grate bar, designed by Milton E. Shantz. The chief new features are: the greater air space, and a freer shaking and dumping motion.

The frame of the new grate consists of a front bar two side bars and two centre bars, together with a rack, all these being made in a very substantial manner. The grate bar consists of two heavy trusses placed close to the edge of the webbs, there are a series of webbs connected with the trusses. All trusses are 3¼ inch wide with a depth of 2 inch of metal at the centre. There is a compound clip at the centre, thus allowing the air to enter freely and spread over the face of the grate.

The Webb is diamond pointed. The reason that this was designed in this manner was to allow the air to reach a large amount of the fuel, and lessen the amount of dead space. The webb is made narrower at the bottom and the air is forced through the narrowest point at the top of the webb and as there is very little dead space at the top of webb, the diamond point forces the air all over the body of the coal, therefore giving good combustion.

The side of the bar on the face of the truss is a continuation of the webb, but is so constructed and reinforced by truss that should a heavy clinker form it can be ground up without any danger of breaking the bar.

The shaking motion consists of a shaker bracket, shaker rod and equilizing bar. The equilizer bar is connected to the shaker rod by a frictionless swivel or knuckle. This is a new device and has made it much easier on the operator, with no strain on the boiler front or bracket, the whole grate is set together without bolts and any part can be removed by the removal of a cotter pin. The back plate is 9 inch wide and when imbedded in the brick cannot be drawn out.

The grate is divided into two halves, so that when a fire is to be cleaned the good fire can be drawn to one side and the ashes dropped into the ash-pit. This operation can be repeated cleaning the other side. In this way no fuel or heat is lost. This is only done occasionally for the shaking movement is adapted to break up a soft coal fire when it cokes or to remove fine ashes from hard coal.

The diamond grates are manufactured by the Diamond Grate Bar Company, Berlin. They manufacture also a steam boat grate on the same principle as the stationary grates. In these the lug to which the shaker is attached can be moved to suit the furnace. It can be made to shake at the side, centre or inside edge of the Great Bar.

The Head Office is the Diamond Grate Bar Co., Berlin, Ont., with branch office room 119 St. James' Chambers, Toronto. The Canadian Patent No. is 118,778.

Improved Diamond Grate.

# Power Supply Markets

### VANCOUVER.

With general activity, trade is reported good. The lumber industry is not particularly busy, though the mills are working about full time, and there is not much prospect now of a marked increase in the demand. Still, building in the city continues active, the value of the permits for the past two weeks amounting to $223,740.

Three by-laws received the seal of the ratepayers' approval at Victoria, all obtaining the required three-fifths majority. As a result several public improvements will be proceeded with at once at Victoria. In extensions to the waterworks $125,000 will be spent, additions to the sewerage system will cost $45,000, and the city share of block paving the Causeway, Belville, Douglas and Humboldt Streets will be about $60,000.

### WINNIPEG.

Power machinery continues to be in demand in the west. Western cities are showing themselves very progressive in installing municipal water and light plants. Up-to-date machinery is being ordered, large sums of money are being spent to secure the best on the market.

LUBRICATING OILS—600 W. cylinder, 80c.; Maple Leaf cylinder, $1 per gal.; 700 A. cylinder, 75c.; Sterling cylinder, 55c.; 600 A. cylinder, 50c.; Capitol cylinder, 59 and 54c.; Solar red engine, 32c.; Atlantic red engine, 29c.; Standard gas engine oil, 36c.; Renown engine, 38c.

GASOLENE—Engine gasolene, gal., 22½c.; f.o.b. Winnipeg, cases, $2.50.

### TORONTO.

There is great activity among dealers in power lines and this seems to be general throughout the country. Consulting engineers have a great number of plants under way and are advertising for tenders. Engineers representing British firms, report some good orders for British machinery while Canadian factories such as Canadian Westinghouse and Canadian General Electric anticipate that increased staffs will be necessary to keep pace with the orders.

BOILERS—There is a good demand for standard return tubular and water-tube boilers. Though the boiler business was the last of the power lines to reflect good times, it is now one of the busiest of power lines, orders being for immediate shipment. One manufacturer in Western Ontario who had a large stock at the beginning of the year is practically without a boiler in stock, having disposed of boilers aggregating over 4,000 within the past few months.

BOILER TUBES—Orders are good. Lap welded steel per 100 ft., 2-inch, $8.50 to $8.75; 2½-inch, $10 to $10.75; 2½-inch, $10.75; 3-inch, $12.00; 3½-inch, $15, and 4-inch, $18.50 to $19.00.

BELTING—The tanners of harness leather have advanced the price of leather four to five cents per pound. All shoe leather has also been advanced. The advance it was thought might affect the leather belting trade but though there is an immediate result in harness leather, it has not affected the leather belting. One reason is because leather belting manufacturers have long term contracts with tanners and are therefore not affected by the rise and fall of the market. Hides to-day are 100 per cent. higher in price than this time a year ago. The business in belting is very brisk and orders are numerous.

LEAD WOOL—Demand is satisfactory with price stationary at $10.50 per 100 lbs. and $200 per ton.

Fire Bricks—Scotch and English, $30 to $35; American, $27.50 to $35 per 1,000.

### MONTREAL.

The condition of the market as far as steam specialties are concerned is very satisfactory and it is pleasing to hear the optimistic views of the dealers in this district. "Bully, just bully" was the way one expressed it to us, and he meant it too. Orders are coming in now so rapidly that they may be said to be crowding and the interesting part is that the influx is steady. No one specialty may be said to have the preference unless it be apparatus for conserving condensed steam such as steam traps. The movement in these has been very active during the past month and there are no signs of a let-up.

Considerable activity (if it may be called such) has been manifested lately in regard to prime movers, both steam and gas engines. It is rather difficult to define any movement in these lines but those connected with the selling end of engine making plants report that they "have no complaint to make about the volume of business doing." This is due somewhat to municipal power enterprises which are under way here in the east.

Western cities and towns are also buying quite extensively in this district from houses who are represented in the western field.

BOILER TUBES—Orders in this line are a little better but still slow, the bulk being in small orders from scattered points, due mainly to repair jobs. Prices are fairly steady although discounts are being shaded in some instances. They are 2-in. tubes (per 100 feet), $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.25 to $11.50; 3½-in., $14.75 to $15.00; 4-in., $18.50 to $19.50.

It will be noted that since our last issue the prices of 3 and 3½ inch tube have dropped slightly.

LUBRICATING OILS—The market continues steady and prices, although the same as reported last month, show a tendency to rise. The current prices (June 11th), are as follows: Cylinder oils, (imp. gal.) 60c. to 80c.; engine oils, 30c. to 60c.; machine and dynamo oils, 30c. to 45c.; shafting oils, 25. to 40c.; lubricating greases (per lb.) 8c. to 12c.

GASOLENE—The demand for this continues strong. There is an ever increasing number of users of small engines for agricultural uses in this district, and it is interesting to note the varied uses to which this power is put, from

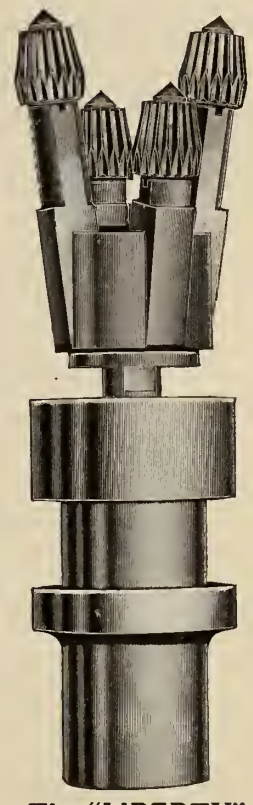
# The "LIBERTY" Economy Quartette

The "LIBERTY" Turbine Tube Cleaner

The "Liberty" Turbine Cleaner is a tube cleaner that can always be relied upon for efficiency and economy. Instead of riding over the scale—as a cheap imitation is liable to do—it cuts the scale and thoroughly cleans each tube to which it is applied.

## The "Liberty" Cyclone Cleaner

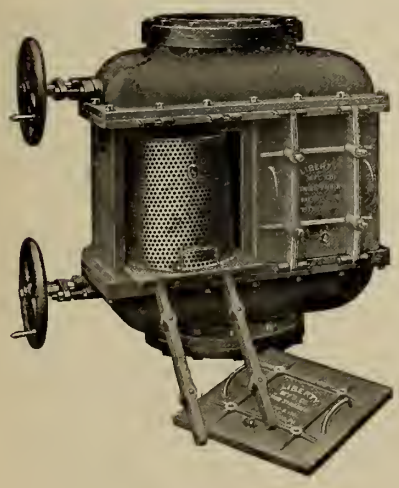
is a rotary motor machine equipped with the Norivet Head and four winged drill points, built for powerful work. It will remove the heaviest scale in less time than is required by any other tool. The Cyclone is the original pneumatic cleaner, but can be also operated by steam.



The "LIBERTY" CYCLONE Tube Cleaner

## The "Liberty" Twin Strainer

has this advantage over other strainers: By a shifting of the valves, one of the basket-shaped strainers can be taken out, cleaned and replaced without interrupting the flow of water. This can be accomplished in one minute. The Twin strainer is indispensable in power plants where a constant flow of clear water is essential.



The Twin Strainer

## The "Liberty"-Greenaway Oil Separator

is the perfect device for taking all the oil out of steam. It can be installed with either wet or dry deflection plates; and the construction is such that either wet or dry plates can be used at will by simply opening or closing a valve. It may be cleaned without breaking pipe connections.

Liberty-Greenaway Horizontal Oil Separator

**Write for our Complete Catalogue of Liberty Power Plant Economies**

# The Liberty Manufacturing Company

**6902 Susquehanna St., Pittsburg, Pa.**

milking cows to cutting wood and pumping water for farm use. At this time of year the demand is always heavy. Our report of the price of gasolene shows a drop of one cent per gallon (from 18½ to 17½ cents) during the past few weeks.

LEAD WOOL—No change has been noted in this line. The demand continues satisfactory with prices steady as last quoted., 10 to 10½c. per lb. on imports and 8 to 9c. on domestic goods.

BELTING—Business is very brisk in this line in Montreal and the east. Also plenty of orders are coming into Montreal houses from western branches. The rise in the price of leather from 4 to 5 cents has not, as yet, made any effect on the price of leather belting. It has been stated as a rather curious coincidence that the rise in the price of leather has usually an inverse effect on leather belting, the price of which tends to drop. Whether this will happen in this case is not easy to decide at the present time, the rise in leather being so recent.

## CATALOGUES.

STOKERS—From American Ship Windlass Co., Providence, R. I., catalogue explaining in detail the Taylor Stokers with illustrations showing construction, parts and several instalations.

ELECTRICAL SUPPLIES—Catalogue from Canadian General Electric, Toronto, describes a number of electrical appliances, including ignition apparatus and automobile accessories, batteries, magneto dynamos, spark plugs, batteries, tungsten lamps, sockets, switches, etc.

TURBINES AND GENERATORS—Catalogue from Ball & Wood Co., Elizabethport, N. J., describing their steam turbine and generator, illustrating a number of instalations with generator direct connected to steam turbine.

STOCK AND DIES—Pamphlet from the Borden-Canadian Co., 66 Richmond St., East, Toronto, illustrating and describing their improved stocks and dies.

COMPENSATOR—Bulletin 1026 describing type F compensators for A. C. circuits from Canadian Westinghouse, Hamilton.

CENTRIFUGAL PUMPS—Catalogue T from D'Olier Engineering Co., Philadelphia, describing horizontal centrifugal pumps, in detail, illustrating details, construction of various sizes for different methods of drive including electric, steam turbine, etc.


# ELECTRIC BARGAINS

7½ H.P. Motor (Westinghouse)
3 " " "
3 " " (C.G.E.)
15 " " (Kay) .
20 " " (United
175 Light Dynamo (Eddy)
Century Single Phase Motor

We manufacture alternating and direct current motors in all sizes. Repairs promptly performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Toronto, Ont.


## MISCELLANEOUS.


AN EXTRA 1 PER CENT. PROFIT.—A National Cash Register will earn at least an extra one per cent. profit for any retail merchant. The National Cash Register Co., F. E. Mutton, Canadian Manager, cor. Yonge St. and Wilton Ave., Toronto, Ont.

ACCURATE COST KEEPING IS EASY if you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe's time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited. Office and factory, 27 Alice Street, Toronto. (tf)

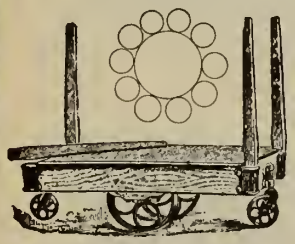
ELLIOTT-FISHER STANDARD Writing Adding Machines make toil easier. Elliott Fisher Limited, 513, No. 83, Craig Street W., Montreal, and 129 Bay Street, Toronto.

CUT DOWN YOUR PRINTING BILLS one half by installing a "Writerpress." Your office girl or boy can with it print your circulars, price lists, etc., at the rate of 1500 to 2000 copies per hour. Best machine ever made for printing facsimile typewritten letters. Prints from printers' type, half-tones, etc. Retail stores could greatly increase their business by using a Writerpress to run off circulars and letters, sending them out to their customers and probable customers announcing special sales, etc. Send for illustrated catalogue and samples. The Canadian Writerpress Company, 33 John St. South, Hamilton, Ont. (tf)

NOTICE!!—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts for the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ont. (tf)

SAVE 50 OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling, and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

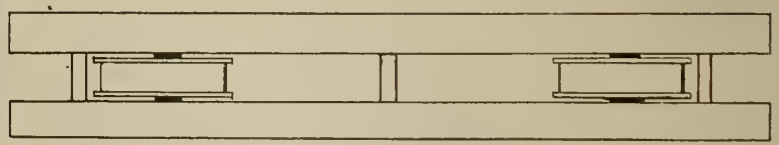
U.S. AND BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD


Roller Bearing Factory Truck

# Roller Bearing Factory Trucks

The only ones made in Canada

# Dry Kilns Installed


Roller Bearing Dry Kiln Trucks

Roller Bearing Transfer Trucks Roller Bearing Lumber Trucks

# MUNICIPAL STEEL BRIDGES

Specifications solicited . .

We make any kind of truck to specifications. Heavy duty trucks a specialty.
Write for prices to

## Corbet Foundry & Machine Co. Owen Sound

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419

# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

# Engineers' Supplies

## Brass and Iron Goods

### J.M.T. Valves "Quality Standard"

Every engineer who has used them knows their value, knows it's a paying investment to instal them—because ***they last.***

Made in J.M.T. Standard and Extra Heavy, with composition, or copper, renewable disc.

Over 25 years of successful service is a guarantee back of all J.M.T. Specialties and Goods bearing our name. The proprietor or up-to-date engineer realizes that ***full weight,*** serviceable Steam Goods are the only kind that should be installed to insure safety and efficiency.

## J.M.T. Injectors

They're made to work under all conditions. Material and workmanship the very best. Satisfaction guaranteed.

***Improved J.M.T. Injectors*** operate under a pressure range of 20 lbs. to 220 lbs. The ordinary injector operates to 160 lbs. only.

***Simple*** ***Efficient*** ***Durable***

Improved J.M.T. Injector

THE James Morrison Brass Mfg. Co., Limited

93-97 Adelaide Street West - - TORONTO

SOUVENIR CONVENTION ISSUE

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C

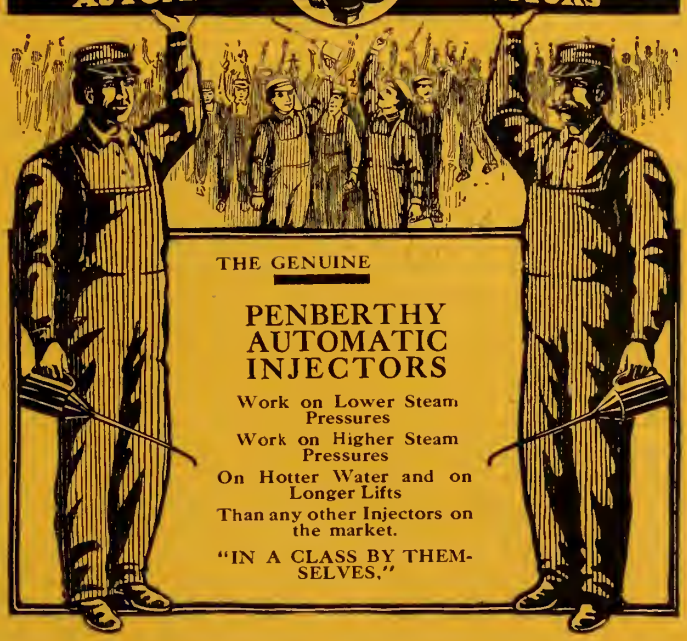
Vol. II. Publication Office, Toronto – July, 1909 No. 7

"I.X.L."
Spring Top Oiler. Cover held by spring and cannot jar off.

"SLIDE TOP"
With Solid Shank & Slide Cover. Very strong and durable.

"SHORT STOP"
Fitted with Snap Lever and Sight Feed Shank. Glass is protected by brass shell. One of our best.

PENBERTHY
AUTOMATIC INJECTORS



THE GENUINE

PENBERTHY AUTOMATIC INJECTORS

Work on Lower Steam Pressures
Work on Higher Steam Pressures
On Hotter Water and on Longer Lifts
Than any other Injectors on the market.

"IN A CLASS BY THEMSELVES."

"SICO"
With Slide Cover and Solid Shank. Very serviceable

"SULTAN"
For Gas Engine Cylinders. Fitted with Check Valve in shank to prevent back pressure entering sight feed glass. It's the best on the market.

## OUR SPECIALTIES

Are used exclusively by leading Stationary and Marine, Steam and Gas Engine Builders in Canada

BECAUSE

Their Design is Pleasing
Their Workmanship and Finish Unsurpassed
Their Utility and Durability not Equalled Anywhere

If you really want the Best you've got to say "Penberthy."

MANUFACTURED BY

**Penberthy Injector Co., Limited**
WINDSOR, ONT.

PRIMING CUP
Made with tee or lever handle. For use on Automobiles, Gas Engines, etc.

# INDUCTION MOTORS

IMMEDIATE SHIPMENT FROM STOCK OF STANDARD RATINGS AND VOLTAGES FROM 3 H.P. TO 100 H.P.

# LIGHTING TRANSFORMERS

LOW CORE LOSS
GOOD REGULATION
HIGH EFFICIENCY
GOOD INSULATION

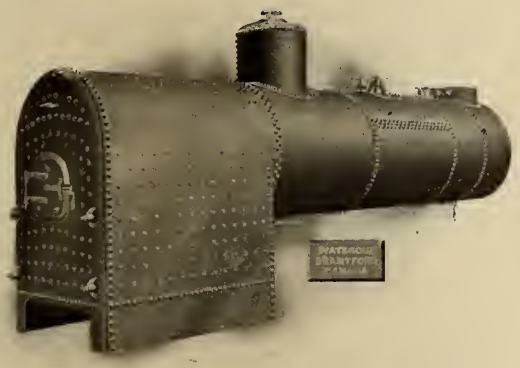
TRANSFORMERS UP TO 50: K.W. CARRIED IN STOCK READY FOR IMMEDIATE SHIPMENT.

## ALLIS - CHALMERS - BULLOCK LIMITED

**Works : Montreal**

***Sales Offices: MONTREAL, TORONTO, WINNIPEG, VANCOUVER***
***COBALT, CALGARY***

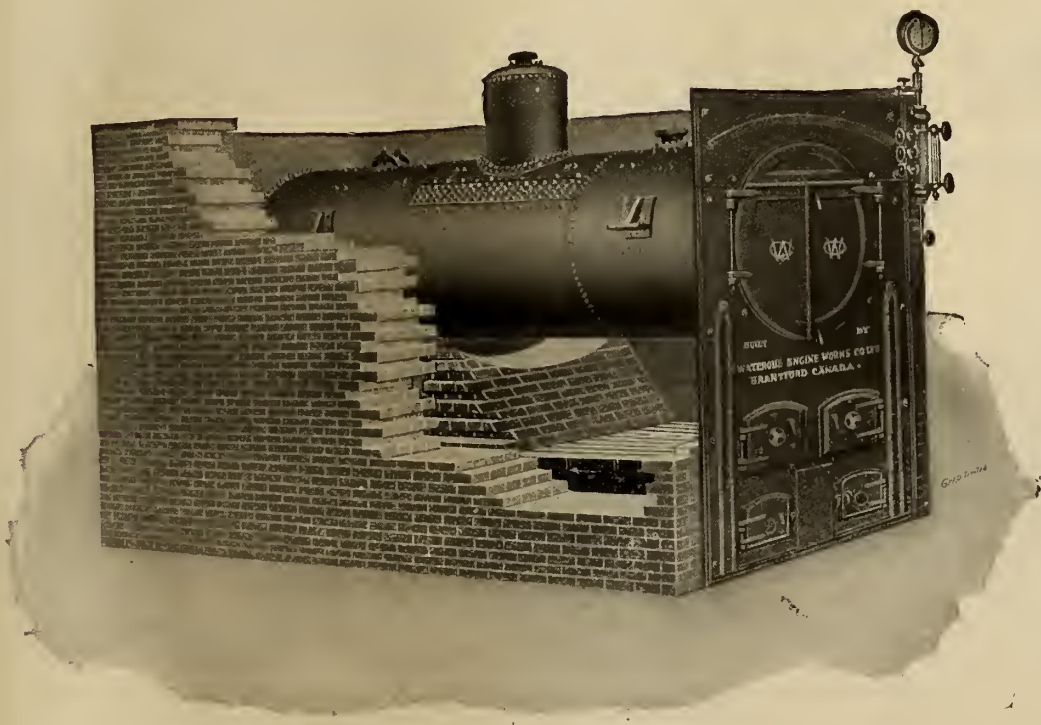
# POWER PLANTS



**Locomotive Boilers**

Built under the British Columbia Boiler Inspection Laws.

10 H. P. to 150 H. P.




**Standard Tubular Stationary Boilers**

The cut represents this style of boiler with ordinary full front setting. Half front and different styles of oven settings can be furnished if desired.

These boilers are built for various pressures and from 10 to 200 horsepower.

We manufacture: Boilers, all types; Stationary, Marine, Automatic, Simple and Compound Engines; Steam Plant Accessories.

**Write for Bulletin and Prices**

## The Waterous Engine Works Co., Limited

**BRANTFORD, - ONTARIO**

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

# No argument is stronger than demonstrated reliability

This fact largely accounts for the circumstance that most of the great steam power plants on the continent are equipped with Heine Boilers. A big plant using hundreds of h p. of steam energy does not choose its boilers in a hap-hazard, hit-or-miss kind of a way. It buys on expert test and judgment, and when it comes to a severe test, Heine Boilers at once prove the safest, most economical and efficient.

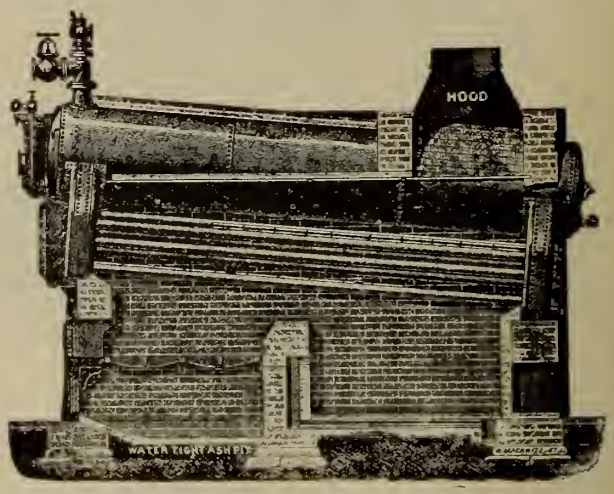



Fig. 1.—Heine Boiler and Setting.

# Heine Safety Boilers

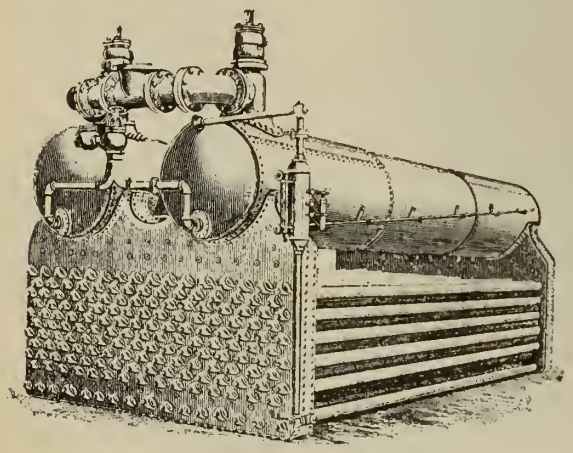


Fig. 2.—The Heine Boiler Without Brick Setting

***Here is a brief idea of their construction:***—The nest of parallel tubes are wholly within the combustion chamber of the Heine Furnace, exposed at every point to the products of combustion passing from flue to stack. The construction of the water and mud drums is such that a constant and ***uninterrupted circulation*** of the water is always maintained. There are no obstructions, sharp turns or vertical tubes; and the throat openings are fully 90% of the aggregate tube area. Absolute safety and great durability is secured by the high quality of the materials, the workmanship, proper arrangement of the parts, avoidance of unequal expansion and contraction, and great accessibility for cleaning and repairs. No cast iron is used in any part. The boiler plates are Homogeneous Steel, made by the Open Hearth Process, having a tensile strength of 55,000 to 62,000 lbs. per square inch. Every plate is subjected to bending, hammering, chemical and other tests of the utmost severity; and the whole boiler is completely set up and tested before shipment.

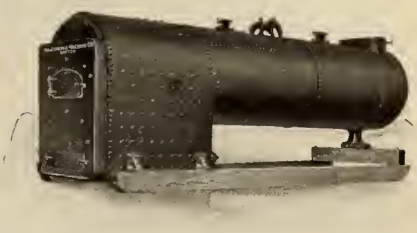
***ILLUSTRATED PARTICULARS MAILED FREE ON REQUEST***

## Polson Iron Works, Limited

## Toronto, Canada

Horizontal Tubular, Vertical Tubular and Locomotive Type

# BOILERS



In all sizes and several styles for every service.

High Pressure Tubular Boilers from 80 to 250 H. P. Our Specialty.

Boiler information sent on request

## The Jenckes Machine Co. Ltd.

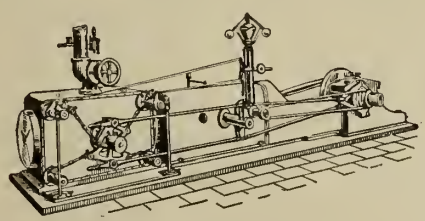
Sherbrooke - St. Catharines - Cobalt

Montreal - Vancouver

Works: Sherbrooke, Quebec. St. Catharines, Ontario.

## ENGINES—

Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper



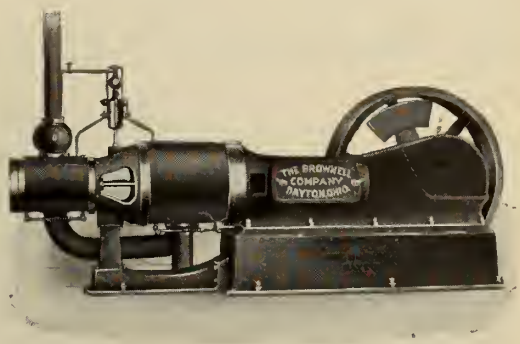
## BOILERS—

Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

LONDON, - ONT.




## The Brownell Company

Dayton, - Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

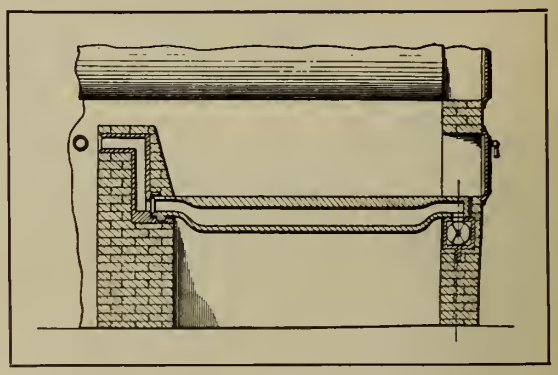
925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# Fleming Grate Bars



An examination of this cut will give some idea of the scientific principle upon which Fleming Grate Bars are constructed. The natural draft entering the **AIR COMBUSTION CHAMBER** causes a continuous passage of air through the grate bars, over the bridge wall and into the combustion chamber, where, now heated to a temperature of 600° F., it unites with the unused carbon, causing a further combustion and a consequent increase in heat units. The never-ceasing current of air, passing through the bars, keeps them comparatively cool, thus preventing the adherence of clinkers as well as insuring them a life which is practically perpetual. In addition to the economy in fuel consumption there will be a proportionate decrease in the labor of cleaning, in the expense of renewing grates—to say nothing of the decrease in smoke.

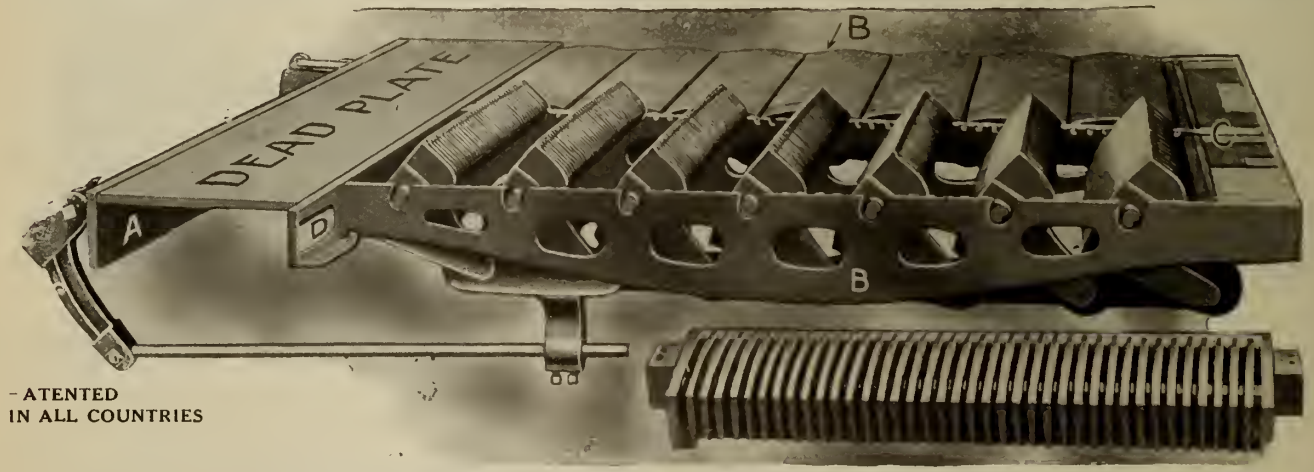
**It means** that with Fleming Grate Bars under your boiler you save from TEN to TWENTY DOLLARS on every hundred dollars worth of fuel you buy.

WRITE FOR BOOKLET.

## BUTTERWORTH FOUNDRY, LIMITED

53 QUEEN STREET, - OTTAWA, - ONTARIO

# The Improved Cyclone Shaking and Dumping Grate




PATENTED IN ALL COUNTRIES

We have recently improved the Cyclone Grate, adding three most important features to it, which increases its fuel-saving qualities and the life of the bar, also making it shake more easily.

**This letter was recently received by our agent in New Brunswick.**

St. John, N. B. May 1st. 1909

G. McA. Blizard, Esq., Canada Permanent Chambers, City.

Dear Sir:—In reference to your enquiry, beg to state we have had the Cyclone shaking and dumping grate bars in use at our Water St. foundry for the past eighteen months.

We consider it one of the best grates of its kind on the market, and if we were installing any more boilers, we would certainly use these grate bars, if they cost three times the money they do, as we consider we have saved double the price of the bars in the last winter. Yours very truly,

T. McAVITY & SONS, LIMITED

C.A.A.

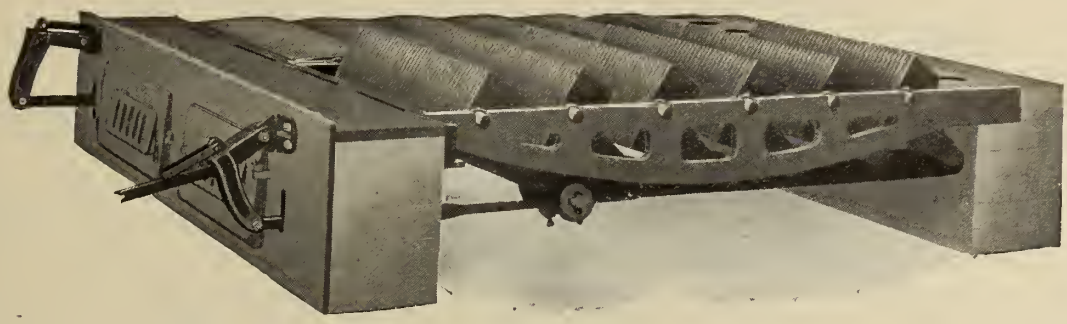
***Write for Circular and Full Particulars***

## Canadian Steam Boiler Equipment Company, Limited

36 and 38 Lombard Street : : : : : : : : : : Toronto

# NEW MODEL
# DIAMOND SHAKING AND DUMPING
# ——GRATE BAR——

*By using Diamond Grates you increase your power from 5 to 20%*



*The Diamond Grate is applicable to any type of boiler and to units of any size.*

CANADIAN PATENT 118,778

## THE DIAMOND GRATE

## Has no Equal as to Simplicity and Durability

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal.

We are giving the names of a few of the Prominent Firms using Diamond Grates.

The Foster Armstrong Co., Berlin
Central Heating Station, Berlin
C. A. Ahrens Co., Berlin
Berlin Button Co., Berlin
D. Hibner Furniture Co., Berlin
J. Kaufman Co., Berlin
A. Bueur & Co., Waterloo
D. Hibner Furniture Co., Listowel
R. Forbes Co., Hespeler
The Muskoka Lakes Navigation and Hotel Co., Gravenhurst
C. Braun Co., Berlin
The Barber Asphalt Co., Toronto
The Alex. Brown Milling Co., Toronto
The City Testing Laboratory and Asphalt Plant, Toronto
The Deaconess Home, Toronto
The Toronto Hospital for Insane, Queen W.
The Toronto General Hospital
The Copeland Chatterson Co., Brampton

We make a Specially Heavy Bar for Steamboat and Malleable Annealing Ovens.

***Boiler Setting and Repairs a Specialty***
***Boiler Tubes, Either Welded or New, at Lowest Price***

*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

A POST CARD OR PERSONAL INQUIRY WILL BRING A PROMPT REPLY

## The DIAMOND GRATE BAR Company

Head Office and Factory, Berlin, Ont.

Branch Office, 119 St. James' Chambers, Toronto. Tel. M 1342

**Try It FREE For 30 DAYS**

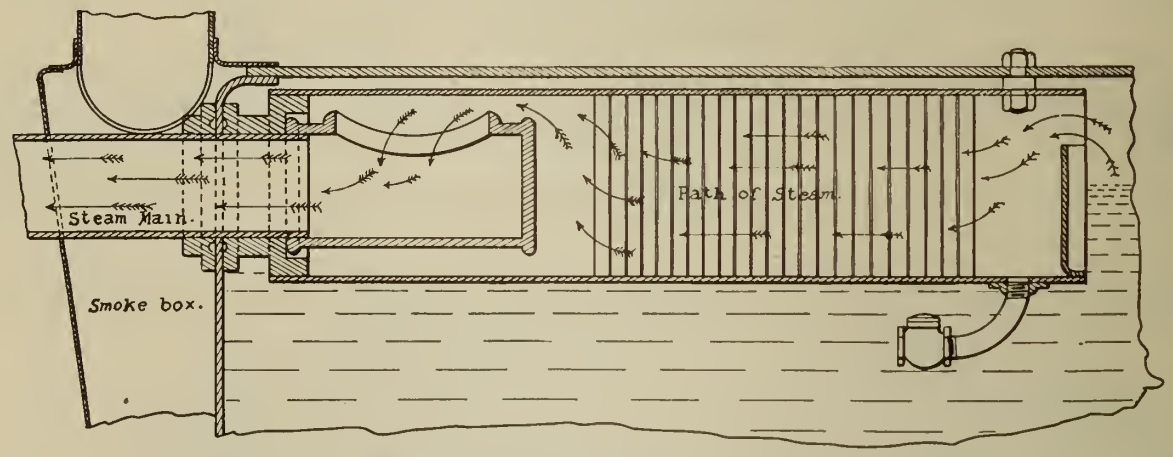
Could any proposition be fairer than this? We will instal the Ideal Internal Steam Separator on your boiler for 30 days free trial, and if it does not come up to our claims we will remove it again without charging you one cent.

## YOU WANT DRY STEAM

Because wet steam is unnecessary, expensive and dangerous. The

# IDEAL INTERNAL STEAM SEPARATOR

delivers dry steam at the Boiler Outlet. It consists of a mechanical casing containing spacing rings, diaphragms, screens and perforated or corrugated plates as conditions call for. It positively eliminates all danger of cylinder heads blowing out or other damage to the engine by reason of water and accompanying foreign matter being entrained with the steam. It is entirely automatic in operation; is placed inside the boiler and **needs no attention.** It accomplishes an immediate and permament saving in Time, Fuel, Oil, Packing and Repairs.




Cut shows an installation of the Ideal Internal Steam Separator in the boiler of the Central Prison, Toronto. This installation was made after the boiler had been put out of commission through water laden steam, although equipped with a well-known line separator. It caused us to receive **the only testimonial ever given out by a government department.**

**The Ideal Internal Steam Separator can be used with profit in every steam plant, particularly on Marine Boilers, Heating, Boiling and Drying Systems, Electric Light and Water-Works Plants.**

FULL PARTICULARS IN OUR ILLUSTRATED BOOKLET
WRITE FOR A COPY—IT'S FREE!

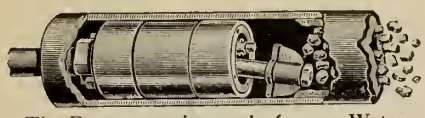
# Ideal Steam Separator & Supply Co.

75 ADELAIDE STREET EAST, TORONTO

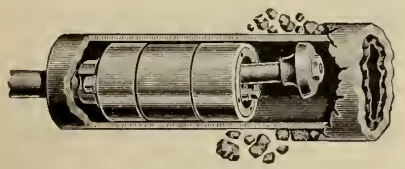
**We also manufacture Potter Separators, Whaley Automatic Smoke Preventers, and Leonhardt Gauge Glass Protectors.**

Selling Agents for Wm. W. Nugent & Co., Chicago, Lubricating Devices; Harris Smokeless Furnace Co., Nashville, Tenn.; Watson & McDaniel Co., Philadelphia, Steam Traps and other steam specialties.

WRITE FOR CATALOGUES



The Dean removing scale from a Water Tube Boiler.



The Dean removing scale from a Return Tubular Boiler.

# Ask Yourself These Questions

Getting all the steam you need?
Boiler giving less power than it did when you bought it?
Any trouble with slow steaming?
Coal consumption any bigger than it used to be for the same amount of power?

**Every Wrong Condition in Your Boiler May Be Traced to Scale.**

Wouldn't you like to know about scale and about

# The Dean Boiler Tube Cleaner?

Write for booklet "From Water to Steam"

**THE WM. B. PIERCE CO., - 330 Washington Street,**
BUFFALO, N.Y.

---

**Every Manufacturer using a steam boiler should know that TRI-SODIUM PHOSPHATE is the only chemical which will absolutely prevent Scale from forming in steam boilers**

(Trade Mark) **B-O-S-A-L-T** (Trade Mark)

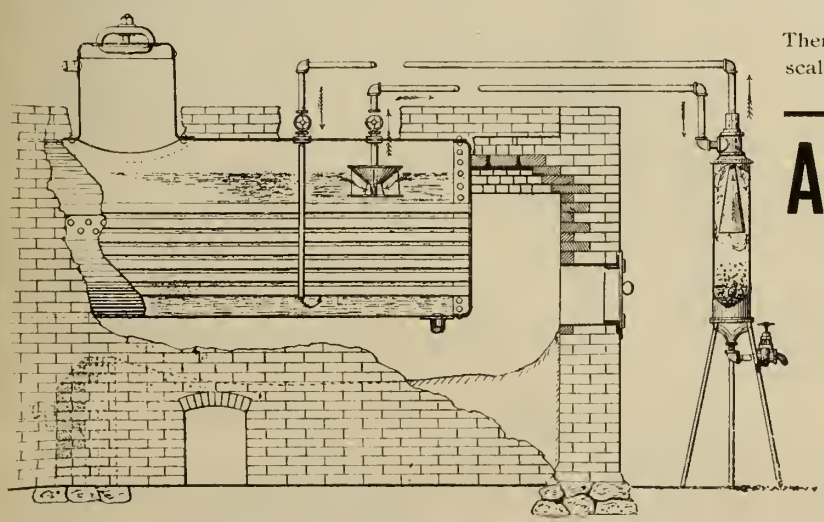
**IS THE GUARANTEED BOILER CLEANER**

Manufactured by

**THE CANADA CHEMICAL MANUFACTURING COMPANY, Limited**
Executive Offices and Chemical Works: London — Warehouses: Toronto and Montreal

---

# Prevention is Better Than Cure



There is just one effective way to keep a boiler free from scale formation, and that way is to use the : : :

**MYERS**

## Automatic Boiler Cleaner

Its logical simplicity of construction will at once appeal to you as a practical engineer. *You take no risk.* We take all chances and give every purchaser the opportunity of trying our boiler cleaner before purchasing. If we did not have a good article we could not do this. : : : : : : :

### This Cleaner is Entirely Automatic in Operaton

and will outlast any boiler to which it is attached. It does entirely away with boiler scale and its attendant dangers and inconveniences, thus eliminating the expensive stoppage of machinery so frequently necessary where scale is permitted to form in a boiler.

First, examine the cut. The conical device let into the top of the boiler and the cylinder standjng upon a pedestal, hack of the hoiler are the two essential features of the Myers Cleaner. The conical device is connected by a slotted tube and four ribs to a disc; it is called the "Skimmer." In the precipitator the impurities are forced to the cooler outside part and are precipitated to the bottom where they may be blown off from time to time. The clarified water then rises through the funnel into the piping and is conveyed to the bottom of the boiler entirely freed from scale forming elements. The ribs in the skimmer serveto break up the scale-forming scum which always rises to the top of the boiler, while the cone guides the scum-laden water into the slots of the tube. The disc catches and retains such scum as fails to enter the tube. From here the scum-laden water rises in the tube and descends into the cylinder called the precipitator

*Send for catalogue giving full particulars. Write for it to-day*

**C. B. TURNER & COMPANY,** P.O. Box 354, TORONTO, CANADA

# Our Business Is To cut out trouble
# To reduce waste
# To give increased efficiency

# Our Business Is growing because we deliver the goods that do the work

**Mason** Reducing Valves, Pump Pressure Regulators, Damper Regulators, Pump Speed Governors, Balanced Valves.

**(Genuine) Ashton** Pop Valves, Pressure and Vacuum Gauges (both indicating and recording), Relief Valves, Alarm Gauges.

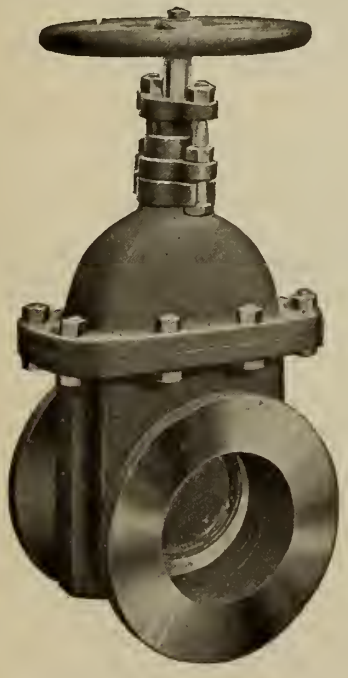
**Reilly** Multicoil Feed Water Heaters, Surface Condensers and Evaporators. The most compact and highly efficient. The lowest is first cost.

**Bundy** Steam Traps, Steam and Oil Separators. The best steam trap made and the most efficient for every service.

These lines appeal to the best judgment of every engineer who takes the trouble to investigate their merits. We represent the manufacturers and are responsible for the reputation of the goods we sell. Our specialty is the economical solution of all problems relating to pressure regulation, and the handling of hot water and returning water direct to the boilers irrespective of temperature or pressure. We have expert engineering service at our disposal.

***ENGINEERS CONFER A FAVOR ON US BY ASKING FOR CATALOGUES AND INFORMATION***

## Peiler & MacKenzie - - - 52 St. James St., Montreal



## *KERR GATE VALVES*

***are to be found in all well equipped steam plants in Canada.***

***The valves with a good reputation are those you should buy.***

***Write for our Catalog of High Grade Brass and Iron Valves.***

***The Kerr Engine Co., Limited***

***Valve Manufacturers***

***Walkerville, - Ontario***

"SENTINEL" Glass Body Oil Cup

Good OIL or GREASE CUPS ought to last a life time. They should have NO COMPLICATED PARTS and should be made of CAST (not spun) BRASS. The feed ought to be easily regulated and the flow steady and positive.

## Lunkenheimer Oil and Grease Cups

are designed according to the above specifications. Largest and most complete line made.

Your local dealer should have them. If not, write us.

WRITE FOR CATALOG

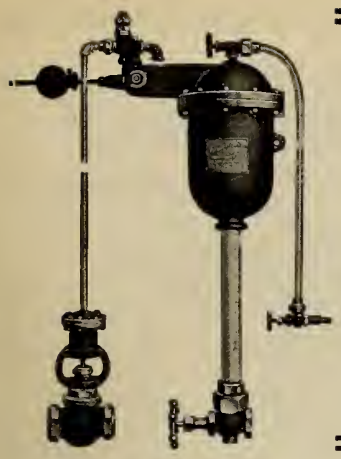
37 THE Lunkenheimer Company

Largest Manufacturers of High-Grade Engineering Specialties in the World

GENERAL OFFICES AND WORKS:
CINCINNATI, : : OHIO, U.S.A.

BRANCHES:
New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., cor. Lake
London, S.E., 35 Great Dover St.

"IDEAL" Grease Cup



# THE VIGILANT FEED WATER REGULATOR

FOR STEAM BOILERS, AND THE

# FULTON PUMP GOVERNOR

are the longest in use a d the mo t popular in the Stat-s.

Ten years ago we sold The Carnegie Steel Company our first order; ten days ago we sold them again, with many orders between.

***Send for catalogue with list of prominent users.***

**The CHAPLIN-FULTON MFG. CO., Pittsburg, Pa.**

# FREE

**ON 30 DAYS' TRIAL**

## "Standard-Crown" Globe and Check Valves

For Steam, Air, Water or Gas.
For any Pressure or Temperature.
Have Removable Seats of very hard Phosphor Bronze.
Repairs cost absolutely nothing
Have no Soft Discs.
Can be Packed under Pressure.
Have Full Discharge.
No Regrinding Machines Required.
Are fitted with Gland Followers

**Canada's Highest Grade Valves**

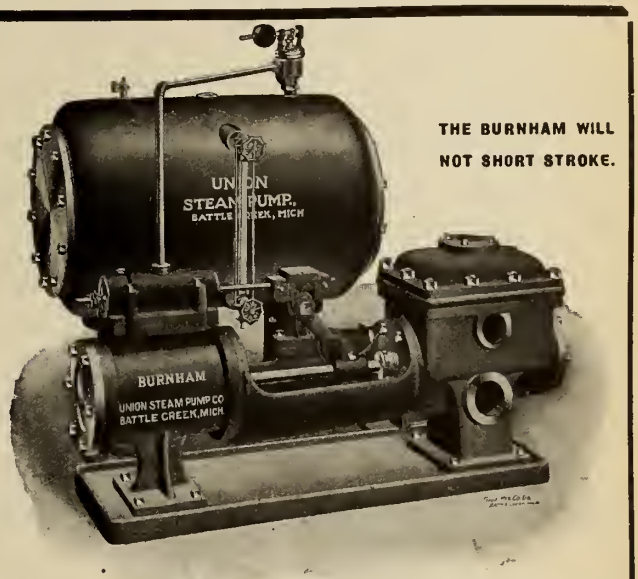
**Are unequalled for quality of material and excellence of workmanship.**

We will send one or more valves to any company or engineer writing on their company's letter head, free of charge on 30 days' trial. If not satisfactory we will take it back. It won't cost you a cent to try, anyhow.

*Send Us a Trial Order or Write for Catalogue*

**The Standard Engineering Company**

**43 Scott Street, Toronto.**




**THE BURNHAM WILL NOT SHORT STROKE.**

## BURNHAM PUMP AND RECEIVER

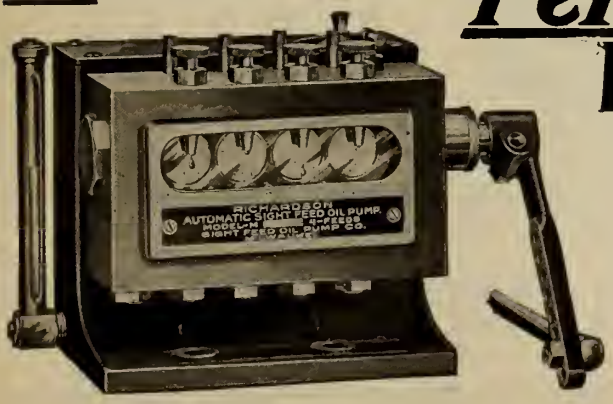
This machine is entirely automatic and will return the condensation from Heating Apparatus, Dryers, etc., direct to the Boiler. The Burnham Pump is Brass fitted throughout and is especially suited for Hot Water service.

**Darling Brothers, Limited**

15 Ottawa Street

**Toronto** **MONTREAL** **Winnipeg**

## This is the Model M




# *Perfect Lubrication With the Model "M"*

The **Richardson Automatic Sight Feed Oil Pump** Model M delivers the right amount of oil at just the right moment in the right manner. For there IS ONE right principle and here it is:

Oil should be delivered to the steam at EVERY revolution of the engine, and no more should be delivered than absolutely necessary. The MODEL M pump fulfills these requirements EXACTLY. Delivering a large quantity of oil every eighteen or twenty revolutions is expensive because fully fifty per cent. runs through the engine and is lost. Uniform quantities at short intervals is THE method, and the MODEL M is THE pump.

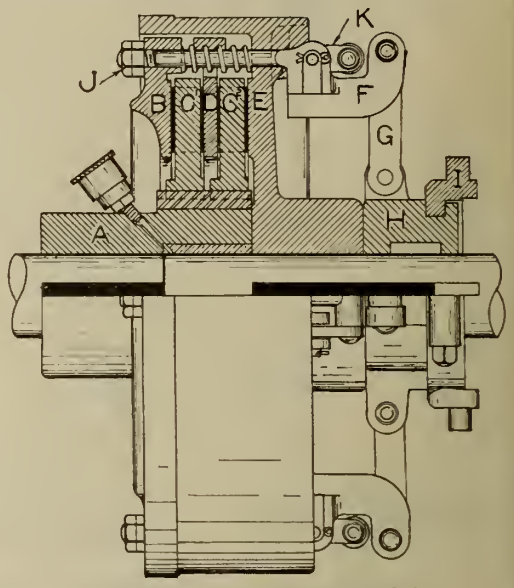
*Send for Bulletin No. 209-L*

**Sight Feed Oil Pump Co., Milwaukee**

# CLUTCHES THAT GRIP

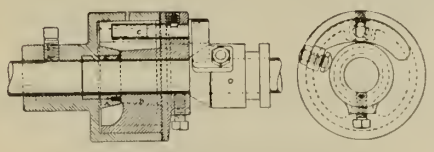
## The "Ideal" Friction Clutch

MADE IN SIZES RANGING FROM 3½ TO 360 HORSE POWER.



"IDEAL" FRICTION CLUTCH

- This Friction Clutch can be made solid or split.
- Perfectly safe, because it cannot start when out of gear.
- Easily adjusted because simply and scientifically constructed.
- Draw Bolts and Straps are made of steel and do not break.
- Big power for size of clutch due to large friction surfaces and powerful lever movements.
- It is provided with solid iron sleeve and split Babbitted sleeve—interchangeable and removable without disturbing the mechanism.
- This clutch is perfectly balanced.


"IDEAL" HUB CLUTCH

## The "Ideal" Hub Clutch

MADE FOR SMALL POWERS RANGING FROM ONE-HALF TO SEVEN HORSE-POWER.

- The "Ideal" Hub Clutch can be thrown in and out easily at high speed—therefore a first-class clutch for countershafts.
- Being simple in construction it is easily adjusted and low in price.
- This clutch can be used in duplex.

**We guarantee these clutches to transmit the Horse Power they are rated at.**

Let Us Send You An "Ideal" Clutch On

# 30 DAYS' FREE TRIAL

If at the end of that time it is not perfectly satisfactory send it back at our expense.

*Write for prices and further particulars, now.*

# IDEAL CLUTCH MFG. CO.

16 PEARL STREET :: :: :: :: :: :: :: :: :: TORONTO, CANADA

# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire box. A patent Back Arch that is both simple and durable- Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

NEW YORK CITY BRANCH, 1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS TROY, N.Y.

# A POWER SAVER

**Is Harris Heavy Pressure Gearing Metal**

WHY?

It Eliminates Friction

Contains in Itself

Great Lubrication

Surely the above will

Save You Power.

WILL NOT

Crack,

Break

Or

Beat Out

of Bearing

**Truly It is Perfection in Babbitt Metal**

Sold and Manufactured by

## The Canada Metal Co., Ltd., Toronto

# Let me tell you this:

**There's sound satisfaction, thorough reliability in every inch of D.K. McLaren's Belting. It lives up to every claim made for it by its manufacturers.**

There's a sound reputation behind every inch of

# D. K. McLaren, Limited

## GENUINE OAK TANNED

# Leather Belting

All hides used in the manufacture of this leading line of Belting are properly trimmed before tanning, when all inferior parts---shoulders, necks and bellies---are cut away. Our tanning process---the Genuine British Oak Tanning Process--- is one that requires the long experience and perfect facilities that we possess; and results in the production of strong, durable leather, equal to the hardest usage.

*Our Regular Lines are*

**"Extra C" and "Standard B."**

SPECIAL GRADES
MADE TO ORDER

Write for PRICE LIST

Write for PRICE LSIT

# D. K. McLAREN, LIMITED

| MONTREAL | TORONTO | QUEBEC | ST. JOHN, N.B. |
|---|---|---|---|
| 309-311 Craig Street West | 200 King Street West | 21 St. Peter Street | 64 Prince William Street |

VANCOUVER
418 Abbott Street

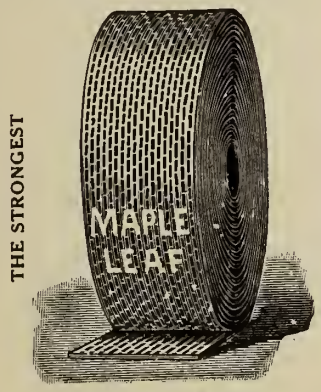
**Full stock of our "Extra C" "Standard B" Leather Belting and "D.K." Balata at above addresses.**

**DOMINION BELTING CO., Limited**
HAMILTON, CANADA

SOLE MANUFACTURERS OF THE CELEBRATED

**"MAPLE LEAF" BRAND**
**Stitched Cotton Duck Belting**
FOR TRANSMISSION OF POWER, CARRYING, ETC.

THE TRUEST RUNNING




THE STRONGEST

THE MOST ECONOMICAL BELT

MADE IN CANADA

As a Main Drive Belt "Maple Leaf" cannot be excelled. Write for prices.

"MAPLE LEAF" BELT DRESSING is the best on the market for all kinds of belts.

"AMPHIBIA" (WATERPROOF) "CLIMAX"

WRITE FOR PRICES

**SADLER & HAWORTH**

FACTORIES AT
MONTREAL—TORONTO

Branches:—
St. John, N.B., Winnipeg, Calgary, Vancouver

# GUARD
## Your Belting Expenses

In buying a belt it is just as essential that you look for lasting qualities as well as a close price. A poor belt can be made to LOOK as good as an honestly made GOOD belt, but when YOU buy a belt look at the factory behind the belt; make sure of the grade of hides used and the parts taken; be sure the methods of manufacture are thorough and backed by "belt brains."

## "Extra," "Standard," "Acme-Waterproof"

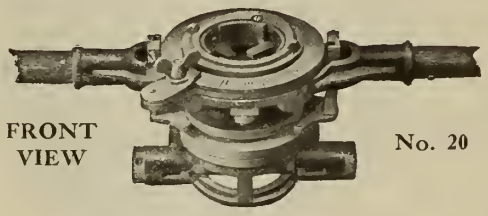
are the brands that stand for all that is best in belt-making, stand for brains. We don't guess at results, we KNOW belt-making, it's our business.

So Specify the Belt of Brains

**J. L. Goodhue & Co., - Danville, Que.**

# JUST THINK OF IT!

One man or boy can easily thread 1", 1¼", 1½" and 2" pipe on a **No. 20 Beaver** without changing dies!!



FRONT VIEW

No. 20

There's no use fussing with a multiplicity of solid dies that are forever getting mislaid when a single Beaver Adjustable Die Stock will do the work of four of them—and do it ***quicker and better.***

The wearing parts of a Beaver are detachable, and may be quickly replaced at any time at slight cost.

We ***know*** that Beaver Die Stocks are the cheapest, fastest and most accurate pipe-threading tools in the world; but

## Maybe you're skeptical!

Well, we will convince you at our own expense. To anyone answering this ad. we will ship any size Beaver stock on 30 days' free trial. Send for one ***now***. Compare it with any stock you can get hold of—and we'll leave it to you.

If you do not find the Beaver to be better than all of them, send it back to us ***collect.*** This trial trip won't cost you a cent above the postage stamp on your letter of request.

No. 4 "BEAVER"

Cuts 2½-in., 3-in., 3½-in. ,4-in. pipe. With a ratchet handle one boy can thread 4-in. pipe.

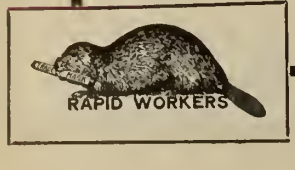
FRONT VIEW No. 6 "BEAVER"

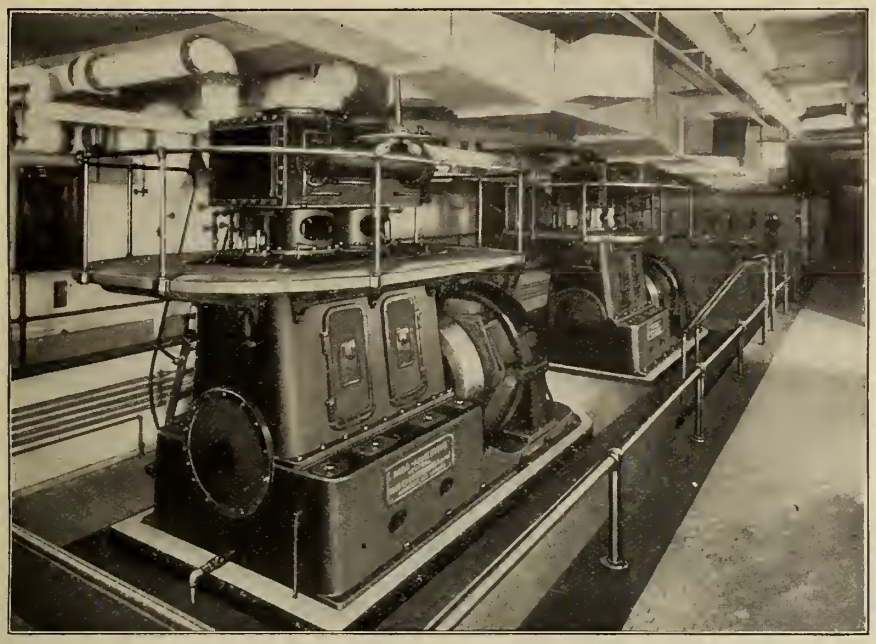
Cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by a single cam, so constructed as to move one set of dies back while the other set is in use.

Write us about this to-day. Remember, this is a genuine offer, without any strings attached. If we were not confident of the Beaver's superiority we would hesitate to make this offer.

# Borden-Canadian Company

66 Richmond Street East, Toronto





# HIGH SPEED VERTICAL ENGINES

of the English enclosed type with pressure oiling system, installed by us at the

**TRADERS BANK,**
TORONTO

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES
709 Power Building, MONTREAL; Watson Jack, Manager.
Traders Bank Building, TORONTO; Wm. McKay, Manager.
Union Bank Building, WINNIPEG; W. F. Porter, Manager
Calgary Block, CALGARY; J. F. Porter, Manager.

LOOK FOR THE WORD

# "DART"

ON ALL FLANGES AND UNIONS

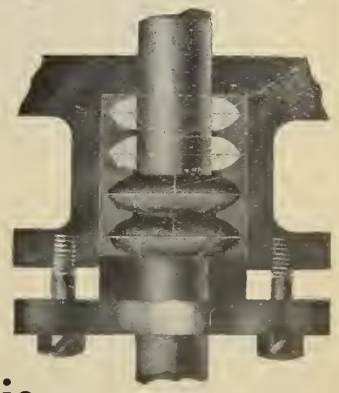
*IT IS an absolute guarantee of highest efficiency*

GET OUR BOOKLET

## DART UNION COMPANY
LIMITED

93-97 Niagara Street, Toronto

## THE Packing That Stays Packed



is

## The Rhodes Improved Metallic Packing

For EVERY service of rod packing and ESPECIALLY ADAPTED FOR AMMONIA.

GUARANTEED!!

Write for Prices and list of Happy Users.

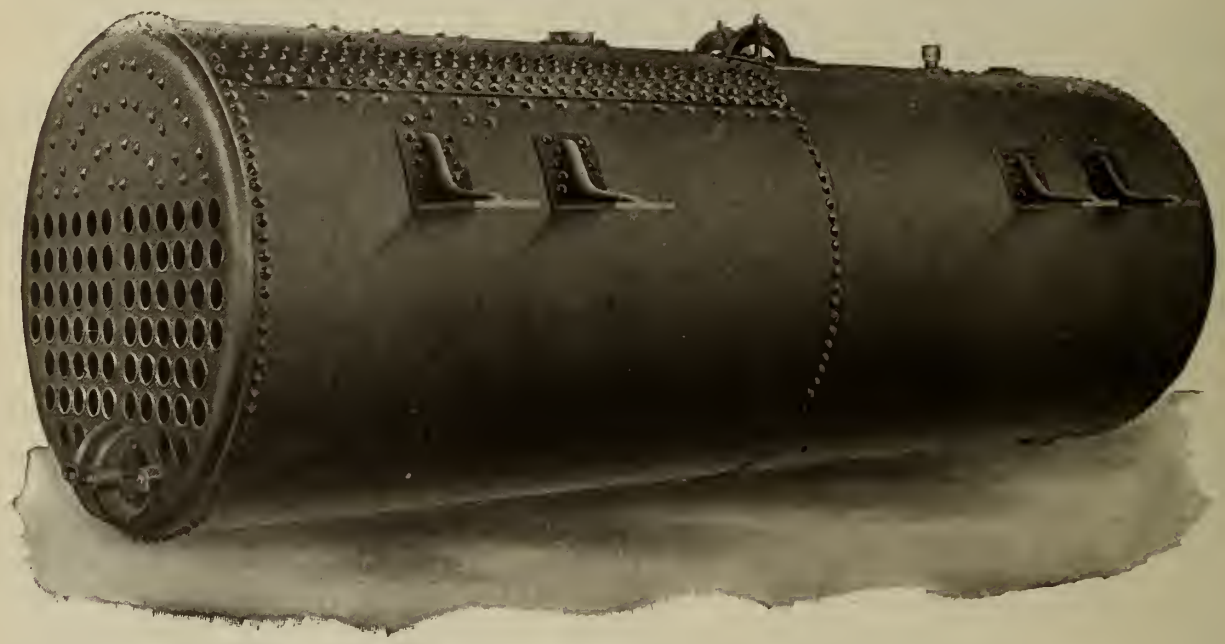
AGENTS WANTED

**The Rhodes Improved Metallic Pkg. Co.**
11 St. Nicholas St., Montreal Limited

# Power Equipment

## Our Engines, Boilers, Heaters, Pumps, Condensers, etc., are prominent in Canada's Largest Power Stations

BECAUSE THEY ALWAYS GIVE PERFECT SATISFACTION



Standard Type of Ontario Boiler, 18 feet long and under.

## WE BUILD FOR POWER HOUSES

**Wheelock Slow Speed Engines, Goldie Corliss Engines, Ideal High-speed Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Return Tubular, Water Tube, Horizontal Marine, Vertical and Portable Boilers, Heaters, Pumps and Condensers**

## The Goldie & McCulloch Co., Ltd.

Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B.C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

# City of London, the C.A.S.E. Place of Meeting for 1909

## A Few Facts in Connection with the Public Works, Public Buildings, Industries and their Growth, and Points of Interest in the Convention City.

London is a city of about 50,000 people, situated half-way between Niagara Falls and Detroit. From east to west the city is about four miles and three miles from north to south. The city is central for a large district and an excellent place for a convention.

The "Forest City," as London is called, affords exceptional opportunities for genuine pleasure and recreation. Situated on the River Thames and surrounded by a rural district of unrivalled beauty, its picturesqueness attracts many visitors. There are many delightful trips to be taken out of London on the electric lines or steam railways. Port Stanley, on Lake Erie, is 24 miles south of London, and here picnics are held.

Springbank Park, owned by the municipality, is situated down the river five miles from London and is one of the finest natural parks. The electric cars run to Springbank the year round and carry immense crowds daily throughout the summer. Other parks are Victoria Park, in the heart of the city, and Queen's Park, in the east end.

The main lines of the G.T.R., C.P.R., P.M.R. and M.C.R. pass through London, and the following branch lines have their headquarters here: London, Huron & Bruce, Sarnia branch, and St Mary's branch. The Wabash Railway also has connections. An interswitching system connects the whole of these railways. A number of radial electric roads are under course of construction.

London Rolling Mills.

G. T. R. Carshops, London.

### London's Public Buildings.

Among its principal buildings are the armories, Wolseley Barracks, customs house, post office, court house, city hall, Masonic Temple, Oddfellows' hall, Y. M.C.A. building, public library, normal school and collegiate.

London's public library is exceedingly well equipped, with 18,650 volumes, which are being constantly added to. The city has two hospitals—Victoria hospital, located in the southern part, and St. Joseph's hospital. London has the Western University, Provincial Normal, military, eighteen graded and four separate schools, and the collegiate institute.

### Industries.

The standing and importance of London as an industrial centre is shown by the great number of manufacturing and wholesale businesses in the city. Factories, covering 75 lines, number 248,

McClary Mfg. Co., London.

Empire Mfg. Co., London.

and employ upwards of 8,000 people. This is exclusive of 400 employes of the Grand Trunk car shops, 1,200 other railway men, 600 men engaged in the building trades and a large number of clerks. Several new industries have started during the past year. Among the industries are, E. Leonard's, engines and boilers; London Rolling Mills, G. Whyte & Sons, McTorey Mfg. Co., Dennis Wire & Iron Co., Murray Shoe Co., Empire Brass Mfg. Co., etc. Manufacturing all kinds of products for almost every use. Many of the above mentioned companies have spent large sums in extensions during the past year.

The mayor of the city is Samuel Steveley, who takes a great interest in the affairs of the city. London is the home of Hon. Adam Beck, who served as mayor for three years, 1902, 1903 and 1904. His hydro-electric schemes, which are receiving world-wide attention, were fathered by him.

S. STEVELEY,
Mayor of London.

## FORT WILLIAM'S WATER SUPPLY.

Fort William expects to be drawing its supply of water from Loch Lomond early in June. The lake lies about eight miles from the city, and has an altitude of about 350 feet above the level of the plain on which Fort William is built. The water is the purest possible, and has been pronounced to be perfect for all domestic purposes. The engineering work of bringing this water into town has been done by day labor under the City Engineer, and will involve an expenditure of over $300,000 before it is completed. To bring the water down required a tunnel through the rocky ridge on the north side of the lake 5,000 feet in length, from the mouth of which the water is to be piped down to a reservoir calculated to hold ten hours' supply for the city, and situated at a lower level than the lake itself, so as to reduce the pressure on the city mains, and at the same time permit of the tunnel being closed and inspected at any time that it may be necessary. From the reservoir an eighteen-inch iron main brings the water across the lands of the Indian Mission to the bank of the Kaministikwia River, where it is carried across the river by a double series of flanged steel pipes, laid thirty feet below the surface of the water, in a trench excavated for the purpose. Thence the eighteen-inch main is continued to the centre of the city whence the water is distributed.

At Loch Lomond the in-take pipe runs 750 feet out into the lake drawing the water from a depth of over twenty feet and from a clear, clean gravelly bottom. It will be conducted into the tunnel through a 36-inch pipe with flexible joints, by way of a gatehouse with concrete base and granite superstructure, built of granite boulders gathered from the glacial drift along the shore of the lake. For two hundred feet from the gatehouse the tunnel is lined with concrete, after which the nature of the rock is such that no lining will be required.

The tunnel, 5,000 feet in length, is the portion of the work upon which interest is mostly concentrated at present. Of the total length there now remains a strip less than 500 feet long, and at the breast of one drift one can now hear the air drills in the other drift at work, the sound being like the distant chugging of a gasoline launch. The drilling is being done by Rand air drills, driven by a Rand compressor, at a pressure of 80 pounds, the machinery being all driven by electricity conveyed across from the city power station.

When the connection is made the area of Loch Lomond will supply water sufficient for a city of 100,000 people for two years, without allowing for any inflow or rainfall. Added to this, the damming of the outlet of the lake at Carp river, can be made to raise the water of the lake an additional six feet, giving three times the amount of water in storage.

---

F. M. G. Johnson, Ph.D., (Breslau) M. Sc., (McGill) F.I.C., (London) has opened an office as consulting chemist in the Eastern Townships Bank Building, Montreal, room 702. General consulting work for all manufacturers will be conducted such as the analysis of all irons, steels, coals, cokes, feed waters, etc. Mr. Johnson has for some time past been connected with the chemical laboratories of McGill University and has had a wide experience both in Europe and on this side of the water.

Masonic Temple, Where London Engineers Meet.

Public Library, London.

# The Twentieth Annual Convention of the C. A. S. E.

## Programme of the Convention to be Held in London, July 27, 28 and 29— Executive Officers, Officers of London Lodge, and Exhibitors' Association.

The twentieth annual convention of the Canadian Association of Stationary Engineers in London, July 26, 27 and 28,

CHAS. KELLEY

Executive President.

promises to eclipse all others in point of attendance and enthusiasm shown by engineers generally. Subjects of vital

W. C. McGHIE

Executive Vice-President.

interest to engineers will be discussed, and from both the educational and social side the convention will be a big success.

The C.A.S.E. is devoted to the education of engineers and the elevation of their profession. The preamble gives the object of the association and in all their meetings this preamble is and should always be the keynote of the stationary engineering profession.

### Preamble.

"This Association shall at no time be used for the furtherance of strikes, or in any way interfere between its members and their employers in regard to wages. It shall recognize the identity of interests between employer and employe, and shall not countenance any project or enterprise that will interfere with perfect harmony between them. Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the promotion of educational, professional and mechanical knowledge."

### PROGRAMME.

#### First Day.

10.30 a.m. Grand opening, including all visitors and ladies, in the City Hall. Adjournment at 12 o'clock a.m.
2.00 p.m. Session until 3.30 p.m.
3.30 p.m. Delegates will be conveyed to Springbank in launches, under the auspices of the Canadian Fairbanks Co. The visitors will be entertained by the C.A.S.E. exhibitors' association, afternoon and evening.

#### Second Day.

9.00 a.m. Session open to 12.00 m.
12.00 m. to 1.00 p.m. inspection of exhibits.
1.00 p.m. The convention will be entertained at the London Hunt "Kennels" by Messrs. E. Leonard & Sons, London, also trip by trolley, returning to the City Hall at 5 p.m.
8.30 p.m. Grand banquet.

#### Third Day.

9.00 a.m. Session open until 12.00 m.
2.00 p.m. Session re-opens for installation of executive officers, and presentation of Past President's jewel, and general closing ceremonies, all visitors and friends present.

### Executive Officers.

The engineers holding the highest offices of the association are popular and have carried out the duties with respect to themselves and the society to which they belong. The following are the executive officers:—

Past President—E. Grandbois, Chatham.

President—Chas. Kelley, Chatham.

Vice-President — W. C. McGhie, Toronto.

Secretary — W. A. Crockett, Mount Hamilton.

Treasurer—A. M. Wickens, Toronto.

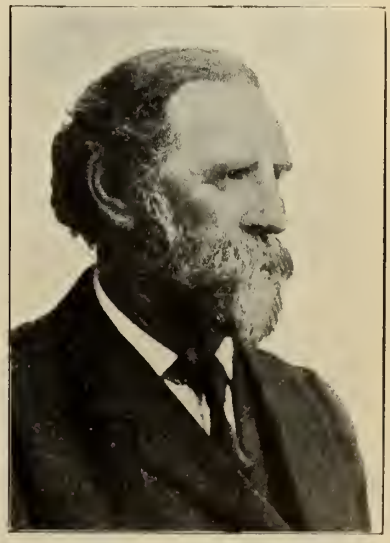
Conductor—J. J. Heeg, Guelph.

Door-keeper—W. Norris, London.

W. A. CROCKETT

Executive Secretary.

W. A. Crockett, the faithful and well-known executive secretary, has intimated that his resignation from the position of executive secretary will be placed before the meeting. Mr. Crocket is one of the



A. M. WICKENS

Executive Treasurer.

best known stationary engineers, who, by his courtesy and his willingness to aid fellow engineers, has made his position as executive secretary felt among the engineering fraternity.

W. NORRIS
Executive Doorkeeper and Hon. Pres. Exhibitors' Association.

JOHN J. HEEG
Executive Conductor.

G. E. MOLL
President London Lodge.

G. D. FOWLER
Treasurer London Lodge.

W. S. ROSE
Vice-President London Lodge.

S. S. GLASS
Past President London Lodge.

W. R. STAVERT
President Exhibitors' Association.

ERNEST A. WILKINSON
Second Vice-President Exhibitors' Assn.

O. A. COLE
First Vice-Pres. Exhibitors' Assn.

**The Program.**

The accompanying program of the convention will give engineers an idea of what may be expected during the three days in London. There will be pleasure combined with business. "All work and no play makes Jack a dull boy," is recognized everywhere in life. The social side has been provided for by members of the Exhibitors' Association, and all attending can count on enjoying themselves.

One of the subjects to the discussed at one of the business sessions will be the advisability of having graded certificates, said certificate to be granted by the Government, and if not then a graded certificate to be issued by a committee appointed by the C.A.S.E., and endorsed by the manufacturers of Canada, certificates to be optional. Another subject for discussion will be the advisability of changing the ritual and constitution.

**London Lodge.**

Preparations for the convention have been largely in the hands of the local lodge, London, No. 30, and the officers have been very active completing preparations for the event. The following are in a measure responsible for the success of the convention:—

President—G. E. Moll.
Vice-President—W. S. Ross.
Corresponding Secretary—W. Norris.
Secretary—A. F. Braithwaite.
Treasurer—G. D. Fowler.
Conductory—J. R. Stephenson.
Doorkeeper—G. F. Galloway.

At the election of new officers the following were elected and will be installed for the coming year:—

Past President—G. E. Moll.
President—F. Campbell.
Vice-President—G. D. Fowler.
Financial Secretary—G. Galloway.
Recording Secretary—J. Stephenson.
Treasurer—J. Greason.
Conductor—J. Reid.
Doorkeeper—J. Middleton.

The following delegates were elected to represent the London lodge at the convention:—Geo. Moll and S. Casford.

**Exhibitors' Association.**

The London City Hall has been loaned to the association for the convention. Besides the meetings, the main hall will be occupied by about thirty exhibitors of steam specialties. This promises to be an attraction, the following list of officers insuring the success of the exhibit:—

Hon. President—Wm. Norris, London.
President — W. R. Stavert, Jenkins Bros., Montreal.
First Vice-President — O. A. Cole, Philip Carey & Co., Toronto.
Second Vice-President—E. A. Wilkinson, Lunkenheimer Co., Toronto.
Treasurer—F. G. Robinson, Canadian Fairbanks Co., Toronto.
Secretary—H. C. Austin, Dunlop Tire and Rubber Goods Co., Toronto.
Assistant Secretary—E. A. Heatherington, Goldie & McCulloch, Galt.

## PERSONAL NOTES.

F. John Bell, Montreal has been appointed general manager of the Mines Power Co., Cobalt. The company are building a 10,000 horse-power hydro-electric plant for supplying power to the various mines in the Cobalt camp.

L. B. Merriam, who resigned his position as Division Engineer on the G.T.P. at Winnipeg, has opened an office in the Builders' Exchange Building, Winnipeg, and will pay special attention to municipal engineering, as well as undertaking railway and irrigation works. He is a member of the Canadian Society of Civil Engineers, and of the Western Society of Engineers.

Norman P. F. Death, B.A.Sc., of Death & Watson, electrical contractors, Toronto, was married on Wednesday, June 16, to Miss Ida May Watson, at Silver Birch Fruit Farm, near Toronto.

The wedding was solemnized of A. A. Bowman, Toronto, Ont., manager of the Canadian Rand Co., and Miss L. Morey, of Sherbrooke, Que. at Sherbrooke on June 23. The ceremony was performed by the Rev. A. Bowman, of Ste. Therese de Blainville, father of the groom. R. G. Black of the Toronto Electric Light Co., was best man.

Roderick J. Parke, A.M., Amer. Inst. E.E., A.M. Can. Soc. C.E., Canadian manager of the British Aluminum Co., Bank Toronto Building, Toronto, has returned from a three months' trip to Europe.

## TORONTO NO. 1 LODGE, C.A.S.E.

The annual meeting of Toronto No. 1 Lodge, C.A.S.E., for the election of officers, was held on Friday evening, June 19, when the following officers were elected for the coming year :

Past President—Frank Stubbs.
President—W. C. Tait.
Vice-President—W. Archer.
Recording-Secretary—A. Kirby.
Financial-Secretary—M. Kerr.
Treasurer—C. Mosley.
Conductor—Geo. Fletcher.
Doorkeeper—Jas. Saunderson.
Trustees—Bros. Marr, Hughes and Black.

Delegates to the convention in London, July 26, 27 and 28, were also elected and are as follows : Bros. Tait, Mosley, Archer and Stubbs. The following alternates were selected to take the place of those elected who are unable to attend : Bros. Bain, McGhie and Marr.

The regular business meeting was held in their rooms, Forum Hall, on Friday evening, July 2. The elected officers were installed by W. C. McGhie, acting as Grand Installing Officer and F. Stubbs as Grand Conductor.

After the installation the new officers were called upon for speeches. The retiring president, Mr. Stubbs, also gave an interesting speech. Considerable business was transacted in connection with the convention in London, July 27, 28 and 29. The president then proceeded to appoint the different committees for the year.

FRANK STUBBS
Past President Toronto Lodge.

W. C. TAIT
President Toronto Lodge.

Entertainment—Bros. Archer, A. M. Wickens, Tweedale, M. Kerr, Kirby, T. McGhie, J. Saunderson and W. C. McGhie.

Labor Committee—Bros. Terry, Marr, Kirby, Stubbs and Archer.

## FINDS IT INTERESTING.

The MacLean Publishing Co.
Enclosed please find one dollar ($1.00) for The Power House from January 1909 to January 1910.
I am well pleased with my paper and find it very interesting.

E. T. FISHER,
Engineer.

### HAMILTON LODGE'S OUTING.

The Hamilton Lodge. C.A.S.E., No. 2, enjoyed a pleasant moonlight excursion on Lake Ontario, Tuesday evening, July 6, 1909. The steamer "John R." was chartered for the occasion, and was her maiden moonlight excursion. The boat left Hamilton at eight o'clock, and a few enjoyable hours were spent on board the boat.

### BRAMPTON LODGE, NO. 36.

A new lodge of the Canadian Association of Stationary Engineers, has been instituted. The following officers were installed by Bro. A. M. Wickens, executive treasurer. on June 25:—

President—H. J. Wickens.
Vice-President—John Pulfer.
Recording Secretary—J. T. Mackle.
Financial Secretary—Harry Bauer.
Treasurer—J. H. Hammond.
Conductor—Charles Burton.
Door-keeper—George Winters.

The delegate to the annual convention in London, July 27, 28 and 29, is H. J. Wickens, the president.

### ENGINEERS' CLUB TORONTO.

William Reavell, M. Inst. M. E., M. Inst. C.E., etc., of Reavell & Co., Ipswich. England, read a paper on "Principles Governing the Compression of Air and Some Notes on its Uses," before the Engineers' Club, Toronto, Monday evening, June 5. E. Wragge, consulting engineer, acted as chairman.

Mr. Reavell described the design and workings of one, two, or three stage compressors, and outlined various methods for testing the efficiency of compressors. He also dealt with the question of relative efficiency of turbo and reciprocating machines. He said that the difficulty of making exact tests, and the difference of opinion which exists as to the proper way in which efficiency should be measured, account for much of the confusion by which the subject is surrounded. If the heat generated during compression could be continuously extracted, so that compression was isothermal, the work done would be a minimum, and the efficiency, consequently, the highest possible. Isothermal compression is quite impossible of realization, though the ideal forms a convenient basis for comparison. On the other hand, one may asume no heat abstracted, and compute efficieny, therefore, on the basis of an adiabatic compression. This is in a sense fairer to the machine, but not so good a guide to the purchaser, particularly if he wants to use his air cold. A third method is that used by Professor Rateau, by which, in the absence of water-cooling the efficiency is deduced from the temperature rise of the air in passing trough the machine.

### N.S.S.E. ANNUAL.

The third annual meeting of the Nova Scotia Society of Engineers will be held in New Glasgow, on Thursday and Friday, September 9 and 10. A good program is being prepared and the meetings will be made of great interest.

### IMPORTANT DEVELOPMENTS IN BITUMINOUS GAS PRODUCERS.

For a number of years the Westinghouse Machine Co. has been engaged in the development of a satisfactory form of producer suitable for gasifying the usual grades of bituminous fuels. The unusual difficulties encountered in the utilization of this kind of fuel have resulted in the trying out of many different types, both of the producer itself and of the necessary auxiliaries for producing clean gas. For the past year and a half, however, the company has been engaged in carrying out upon a commercial scale, a producer plant which is now upon the market. These tests have not been conducted with a toy apparatus but with a full sized equipment of 175 h.p., including a standard gas engine of about the same power, by means of which the actual power value of the gas produced and the over-all efficiency obtainable were determined without possibility of error.

These above-mentioned tests were brought to a conclusion on April 3 by drawing the fire in the producer after it had been in continuous operation on various loads and on various fuels for a year past, these twelve months having been devoted to tests of one to four weeks' duration, both ten and twenty-four hours per day on standard fuels available for power purposes. These fuels included Pittsburg slack and run-of-mine, lignites from Northern Colorado, Texas and South America, also peat and other fuels from various parts of the country. In most of the tests the load on the equipment was maintained at full rating, although one special test of one month and a half duration was made to determine accurately the standby loss of the producer standing idle.

The drawing of this fire after one year's operation was made the occasion of a demonstration of the producer plant before government officials and engineers from various parts of the country especially interested in bituminous gas practice.

The fire was drawn without trouble or interruption, as large clinker formations were entirely absent, although the producer had, just previous to this occasion, been running on a full load test for one month, using Pittsburg coal. The lining of the producer was found to be practically intact and in quite good enough condition for continued operation for an unlimited period.

A detailed examination of the piping leading from the producer house to the engine on test, showed that during this long period of operation there had been no deposits of tar or lampblack. As a matter of fact, this piping had not been examined for about two years and a half of producer experimentation.

The most important feature of the demonstration was the entire absence of tar formed in the producer gas. A similar examination of the mixing and inlet valves of the engine which has been used for the past year on this test, showed practically no deposits of tar or lampblack, such as would interfere with the operation of the engine. The Westinghouse plant uses no tar extractors, as no tar is made, simply a static washer of small size in the place of the usual bulky coke scrubber. A rotary exhauster draws the gas from the fuel bed and delivers it to the engine at a definite pressure.

No gas holder is used in this process, as the producer regulation is entirely automatic. The gas produced has a moderate heat value suitable for high compressions in the gas engine, and is uniform and clean, average samples showing not more than .02 to .03 grains per cub. ft. impurities.

The ash is fairly clean, and analysis of samples from time to time shows that not more than 1 per cent. to 3 per cent. of the combustible in the coal escapes in the ash.

The various fuels which have been used in this producer on test have been gasified successfully and have run as high as 34 per cent. moisture, 35 per cent. volatile and 15 per cent. ash and 1½ per cent. sulphur. The results of the tests show that with coal, such as Pittsburg slack or run of mine, an over-all economy of 1.1 lbs. per brake h.p. hour can be secured, equivalent to a little over 9-10 lb. per indicated h.p. hour. Moreover, the producer efficiency does not vary more than 10 per cent. from full load on the plant to no load.

The results of this past year's tests have fully convinced the builders that the apparatus experimented with possesses unusual commercial value, and preparations are being made for extensive manufacture. A plant of this type has been in operation for over six months on Colorado lignite coal with equal success, as evidenced by an order recently placed with the Westinghouse Machine Co. for duplicate equipment.

# Developments in Manufacture of Gas Producers *

**Gas Producers are Being Improved so that Better Results are now Obtainable with Producer Gas as a Source of Power, than Formerly.**

By J. DYMOND **

Two kinds of pressure gas producers using anthracite coal are being supplied and are recommended where gas is wanted for any other use outside of working the engine. Plants are built on this system up to 500 b.h.p., the consumption of coal with a good commercial anthracite does not exceed one pound per b. h.p. When working at or near sea level it has been found not to exceed 8-10 of a pound.

A new bituminous gas producer is also being introduced on the market which possesses great advantages, embodying improvements which convert all the foreign elements contained in the coal, into a fixed gas, burning up, and destroying all the tarry matter.

This producer is capable of driving engines up to any size and the gas produced can be used for various other purposes. The machine is applicable for marine, as well as for fixed or stationary work, and is also suitable for illuminating purposes, the constituent parts of the gas being of such a nature and high in heat units, possesses a very brilliant luminosity when used in conjunction with a good incandescent mantle, and can also be used for lighting with an open burner when slightly enriched with any hydro-carbon and the gas produced at very low rate per cubic foot.

This system of gas-making is especially adaptable for forge welding and furnace work, annealing, brazing and other purposes.

The writer is of the opinion that gas manufactured under these patents and process, will, in the near future, in connection with an especial designed gas engine, supersede the steam locomotive for railway purposes.

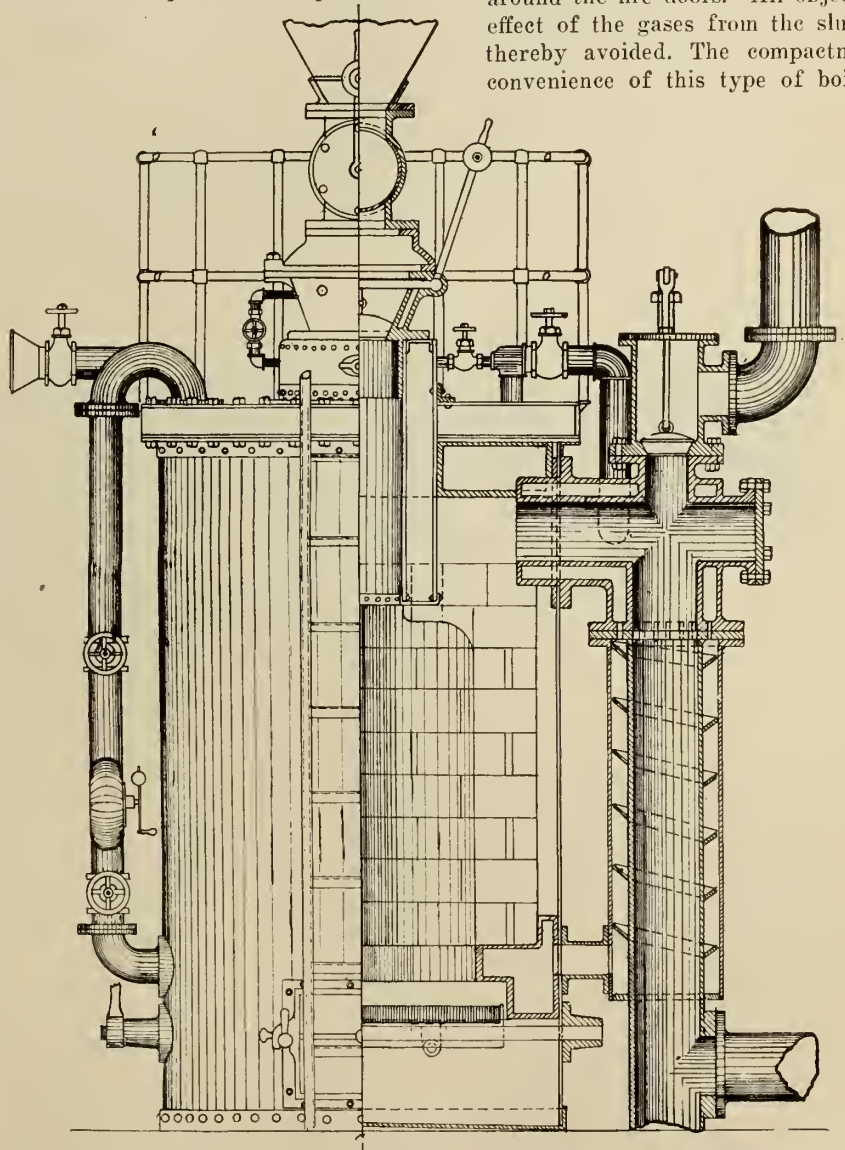
Towns may be heated as well as illuminated by gas from this system, being very economical.

### Well Built Machines.

Not only must the machines be built on scientific principles, embodying all the most essential features to produce the highest known thermal efficiency, but must be strongly and substantially built. They should be made a lasting machine, the life of which should not be less than twenty years, the workmanship should be as good as can be obtained for work of that nature and that nothing but machines that are capable of giving absolutely satisfactory results should be considered.

The purchasing public should seek to obtain their information from men of practical experience on whose judgment they can depend.

It is an indisputable fact that gas engines driven by good gas producing machines can be relied upon for all classes of work and power development.



225 H. P. Suction-Pressure Dymond Gas Producer.

### BURNING SEWAGE SLUDGE.

For a considerable period the Metropolitan Water and Sewerage Commission, of Massachusetts, has followed the practice of compressing into blocks the material screened out from the sewage before it enters the pumps and utilizing it for fuel beneath their boilers. They early learned, however, that the brick work was burned out very rapidly whenever this fuel was used in connection with the externally-fired boilers. On the other hand, it was found to have no effect upon the steel plates. As a result internally-fired boilers have been adopted.

In the recent installation made at Deer Island, in accordance with plans by F. W. Dean, of Boston, a number of horizontal return tubular boilers were replaced by those of the internally-fired type. Scotch boilers were adopted, the combustion chambers being made of steel plate with water spaces, and without brickwork except in the bridge walls and around the fire doors. All objectionable effect of the gases from the sludge was thereby avoided. The compactness and convenience of this type of boilers are shown by the fact that they met the requirements where there was insufficient room for vertical boilers, and where the locomotive type could not be used, because of lack of space to remove and replace the tubes; while with the Scotch type, the tubes could be drawn within the firing space of the boiler house.—Municipal Journal and Engineer.

* The first article on this subject by Mr. Dymond appeared in the May, 1909, issue.

** Mechanical Engineer of Dymond Gas & Engine Co., Toronto.

# Plan for the Purchase of Coal on its Heating Value

**By Buying Coal According to Heat and Ash Specifications the Purchaser gets more Nearly what he Pays for and Pays for What he Gets.**

The plan inaugurated two years ago by the United States Government for the purchase of coal on its heating value has resulted in the delivery of a better grade of fuel without a corresponding increase in cost and with therefore a saving to the Government. At the present time, forty departmental buildings in Washington, the Panama Railroad, more than 300 public buildings, throughout the United States, navy yards, and arsenals are buying their fuel supplies on specifications, the prime element in which fixes the amount of ash and moisture.

Premiums are paid for any decrease of ash below 2 per cent. from the standard at a rate of $.01 per ton for each per cent. Deductions are made at an increasing rate for each per cent. of ash when it exceeds the standard established by 2 per cent.

It has been demonstrated by the United States Geological Survey, technologic branch, which has charge of the analyses of the coal that under these specifications the Government has been getting more nearly what it pays for. and paying for what it gets.

The purchase of coal on specifications is but one of the activities of the Government looking toward a more efficient use of the fuel resources of the country. Engineers of the Geological Survey are studying the problem in all its phases at the experiment plant, in Pittsburg, Pa. The investigations, by suggesting changes in furnace equipment and in methods of firing the coal, are indicating the practicability of the Government purchasing cheaper fuels, such as bituminous coal and the smaller sizes of pea, buckwheat, etc., instead of the more expensive sizes of anthracite, with a corresponding saving in price. The fuel bill of the Government now aggregates about $10,000,000 yearly, the saving on which, through securing coal containing less ash, alone amounts to $200,000.

Since the Government has been purchasing coal on the basis of its heating value a growing interest has been manifest on the part of manufacturers and the general public in this important subject and a demand has been created for authentic information concerning the results accomplished. In response to this demand the results of the Government's purchases of coal under the heat value specifications for the fiscal year 1907-8 have been assembled in a bulletin just issued by the Survey in the hope of promoting a better understanding of this method of buying fuel. John Shober Burrows, the engineer in charge of this part of fuel problem, has included in the bulletin a list of the contracts with abstracts of the specifications for the current fiscal year.

In explaining the nature of the specifications, Mr. Burrows says:

"Government specifications are drawn with a view to the consideration of price and quality. For manufactured articles and materials of constant and uniform quality they generally can be reduced to a clear statement of what is desired. For coal, however, the variation in character makes this impracticable.

"This lack of uniformity is the feature recognized and provided for in the coal specifications prepared by the Geological Survey. Under these specifications, bidders are requested to quote prices on the various sizes of anthracite, a definite standard of quality being specified for each size, and to furnish the standard of quality with price for bituminous coal offered. Awards are then made to the lowest responsible bidder for anthracite, and to the bidder offering the best bituminous coal for the lowest price. The specifications become part of the contract, and the standards of quality form the basis of payment for coal delivered during the life of the contract. For coal delivered which is of better quality than the standard, the contractor is paid a bonus proportional to the increased value of the coal. For deliveries of coal of poorer quality than the standard, deductions are made from the contract price proportional to the decreased value of the coal. The actual quality and value of coal delivered is determined by analyses and test of representative samples taken in a specified manner by agents of the Government and analyzed in the Government fuel-testing laboratory at Washington."

### The Advantages of the System.

The advantages of buying coal on specifications are explained by Mr. Burrows as follows: "The advantages of this system of purchasing coal may be briefly summarized as follows: Bidders are placed on a strictly competitive basis as regards quality as well as price. This simplifies the selection of the most desirable bid and minimizes controversy and criticism in making awards. The field for both the Government and dealers is broadened, as trade names are ignored and comparatively unknown coals offered by responsible bidders may be accepted without detriment to the Government.

"The Government is insured against the delivery of poor and dirty coal, and is saved from disputes arising from condemnation based on the usual visual inspection. Experience with the old form of Government contract shows that it is not always expedient to reject poor coal, because of the difficulty, delay and cost of removal. Under the present system rejectable coal may be accepted at a greatly reduced price.

"A definite basis for the cancellation of contract is provided. The constant inspection and analysis of the coal delivered furnishes a check on the practical results obtained in burning the coal."

A few years prior to the adoption of the present system the necessity for a uniform standard in the purchase of coal became apparent to a few of the Government departments, and the plan of purchasing on the heat-value basis was introduced. It proved successful, especially in the Treasury Department, under which purchases are made for the post offices and other public buildings throughout the United States. The Treasury Department had at that time a well-equipped laboratory and was thus enabled to do all of the necessary testing. Other departments were unable to follow the example of the treasury because of lack of information and proper facilities. In 1904, at the Louisiana Purchase Exposition, at St. Louis, the Geological Survey began a comprehensive study on a practical scale of the utilization of coal, J. A. Holmes being placed in charge of the work. These investigations are still in progress at Pittsburg, Pa., and they have resulted in making authentic information of great practical value available to the public, as well as to the Government departments. This work led up to the development of a general and uniform specification plan for purchasing the Government fuel supply.

---

## BUY HIGH-GRADE LAMPS.

When purchasing metallic filament lamps great care should be taken to see that the lamps are of high-grade quality and are manufactured by a firm who have a reputation to lose. A great number of inferior lamps are being hawked about the country and sold to unsuspecting traders and the public generally, with the result that the user is quickly dissatisfied and condemns metallic filament lamps in general as being unreliable and short-lived.

---

## LIKED THE BOILER ISSUE.

Toronto, Ont.

Editor "The Power House."

You must be commended for the excellent June Boiler issue. The subjects are well chosen and are of great interest to engineers in Canada, for the subjects are chiefly Canadian.

F. STUBBS, Pres. No. 1, C.A.S.E.

# Method of Setting the Valves of the Wheelock Engine*

## Full Directions for Setting the Valves, Both Exhaust and Cut-off—The Governor—Some Helpful Suggestions re Operating Wheelock Engines.

The general design of the Wheelock engine built by the Goldie & McCulloch Co., Limited, is as shown in Fig. 1. The features of the Wheelock engine is its simplicity of construction, its economical action and great durability.

The chief points of the cut-off gear are its simplicity, fewness of moving parts, small amount of power absorbed in working it, absolute control which the governor has over the slightest variation in the load of the engine and the economy of steam thus obtained.

The valve plugs are fitted to separate seats and are driven into tapering holes in the cylinder (as shown in Fig. 3) and require no further fastenings. No bonnets are used. The valves are flat slides with multiplicity of openings and large area with minimum of movement. By the use of a knuckle joint movement very slight lap is required and almost instantaneous opening and closing are secured. By the arrangement of the valve movement the cut-off is very effective and positive in its action as the cut-off valves have but slight movement after closing, while the knuckle joint allows of continued movement of the mechanism without moving the valve.

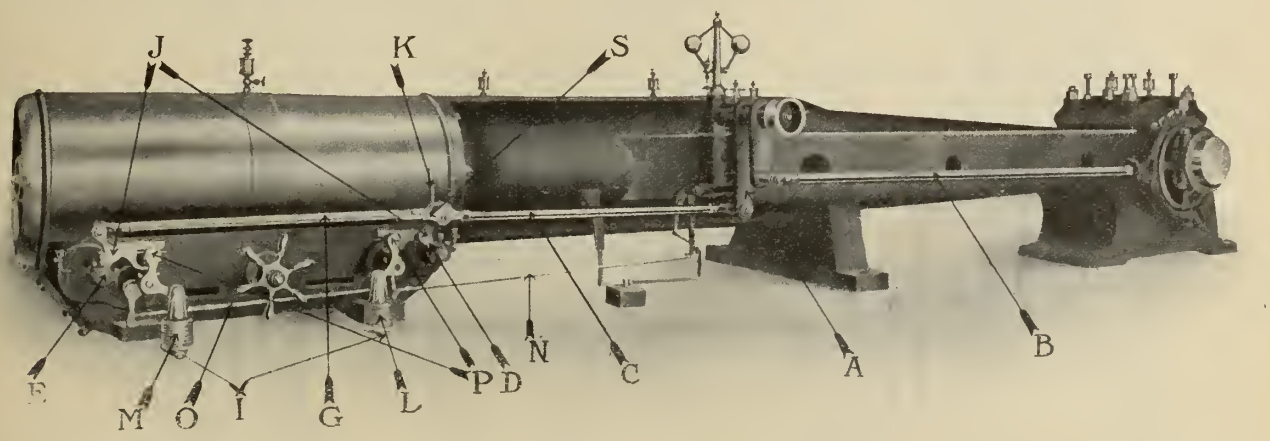



Fig. 1.—General Design of the Wheelock Engine.

### To Set the Valves.

To set the valves we will assume that the valve motion and rods are all on the engine as shown in Fig. 1.

### Exhaust Valves

In all cases the eccentric must follow the crank. First throw the eccentric on the extreme both ways and note if rocker arm (A) travels equal distances past the centre line, if it does not lengthen or shorten eccentric rod (B) (which has a right and left hand thread) until it does. Then place the eccentric on the extreme again with hook rod (C) in position. Drop a plumb line over the pin between the latch hook and exhaust arm (D). Measure from line to side of valve spindle. Throw the eccentric on the opposite extreme, drop the plumb line over the other side of the pin and measure from line to side of spindle. If these two measurements are not the same adjust hook rod (C) until they are. This rod can only be adjusted on the rocker arm end and nothing less than one turn. If adjustment is wanted closer than this to get arm (D) to travel equal distances both ways, slightly lengthen or shorten eccentric rod (B). (This rod has right and left hand threads). Set exhaust arm (E) in same manner as arm (D), any adjustment required being got by lengthening or shortening wiper rod (G). (This rod has right and left hand threads). After this is completed the three rods will be the proper length and exhaust valves set. Set rod nuts up tight.

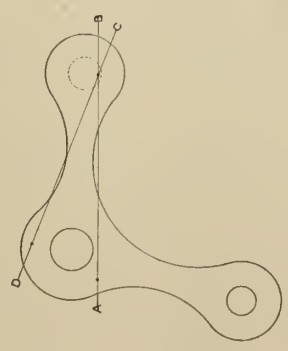


Fig. 2.—Cut-off Arm.

### Cut-off Valves.

On Fig. 2, showing the cut-off arm (P), note lines marked AB and CD. AB, when plumb, indicates the position of cut-off valve when closed with the proper lap. CD, when plumb, indicates the lead point, i.e., the point where the cut-off or steam valve is just opening. The faces of the two cut-off arms have either lines or prick punch marks to correspond with Fig. 2. With the cut-off valves closed hang a plumb line over the face of each cut-off arm (P) and turn the eccentric dash pot studs (I) around until the line AB on each arm is plumb. Care should be taken to have the two eccentric studs (I) set in the same relation one with the other, i.e., either both towards the centre or towards the ends of the cylinder. The exhaust and cut-off arms are now set. To set latch hooks, throw the main eccentric ahead to the extreme position, then turn pin (J) at the frame or front end of cylinder until the latch plate travels over latch block 1-16 inch. Then throw the eccentric to the other extreme and set the other latch hook the same as above. Be sure studs (J) are in the same relation one with the other.

To get proper position for eccentric on crank shaft put the engine on forward dead centre, see that the front latch hook is engaged and turn the eccentric around on the shaft the same direction that the engine runs until the line on the front cut-off arm (CD, Fig. 2) is plumb. Secure the eccentric at this position. Turn the engine the way it runs to the opposite centre and set

* Third of a series of articles on setting the valves of the different makes of engines on the Canadian market. The first article appeared in the April and the second in the May issue.

the other cut-off arm the same, following the same instructions as before. If CD is not plumb on both ends adjust the main eccentric a little to divide the difference between the two ends. After this is completed, secure the eccentric on the shaft. This finishes the setting of steam and exhaust valves.

### Governor.

On the front of the dash pots will be found two prick punch marks, one on the bottom of the dash pot and one on the part that lifts. These punch marks should be the same distance apart when the dash pots are at rest. If they are not, and the cut-off valves have been set correctly as described above, alter one set of marks to correspond with the other. Unhook the gab hook (S) and lift dash pot (L) till the line CD, Fig. 2, is plumb as shown by a plumb line. Set a pair of compasses to the prick punch marks on dash pot at this point. Raise the governor and fit a piece of wood into slot in governor top, so that there is 5-16" between bar connecting governor arms and top of slot. Adjust rod (N) until dash pot trips off at the point when the prick punch marks are the distance apart shown by the compasses. Set dash pot (M) in same manner, adjusting rod (O) to trip dash pot off at the point when prick punch marks are the distances apart shown by compasses.

It is evident that the use of prick punch marks and compasses is simply a more convenient way of working than a plumb line on the valve arm, Fig. 2. Then drop the governor until there is 3-16" between bottom of cross bar and bottom of slot. Work the valve motion by means of handle (K) and latch hooks should not hook on with governor at this point. Be sure the latch hooks do not take hold when governor is 3-16" from bottom and also that they trip off when governor is 5-16" from the top.

The speed at which governor should run is 170 revolutions. Care should be taken to have all the joints of governor rods free. Any binding in these will have a tendency to make the governor unsteady. Should any of the acorn nuts screw on a little too far and pinch the rods, put a small piece of lead in the bottom of the hole before screwing on. When valves are set in shop the eccentric hook and wiper rods are all marked their proper length with chisel marks. The position of eccentric on the shaft is also marked.

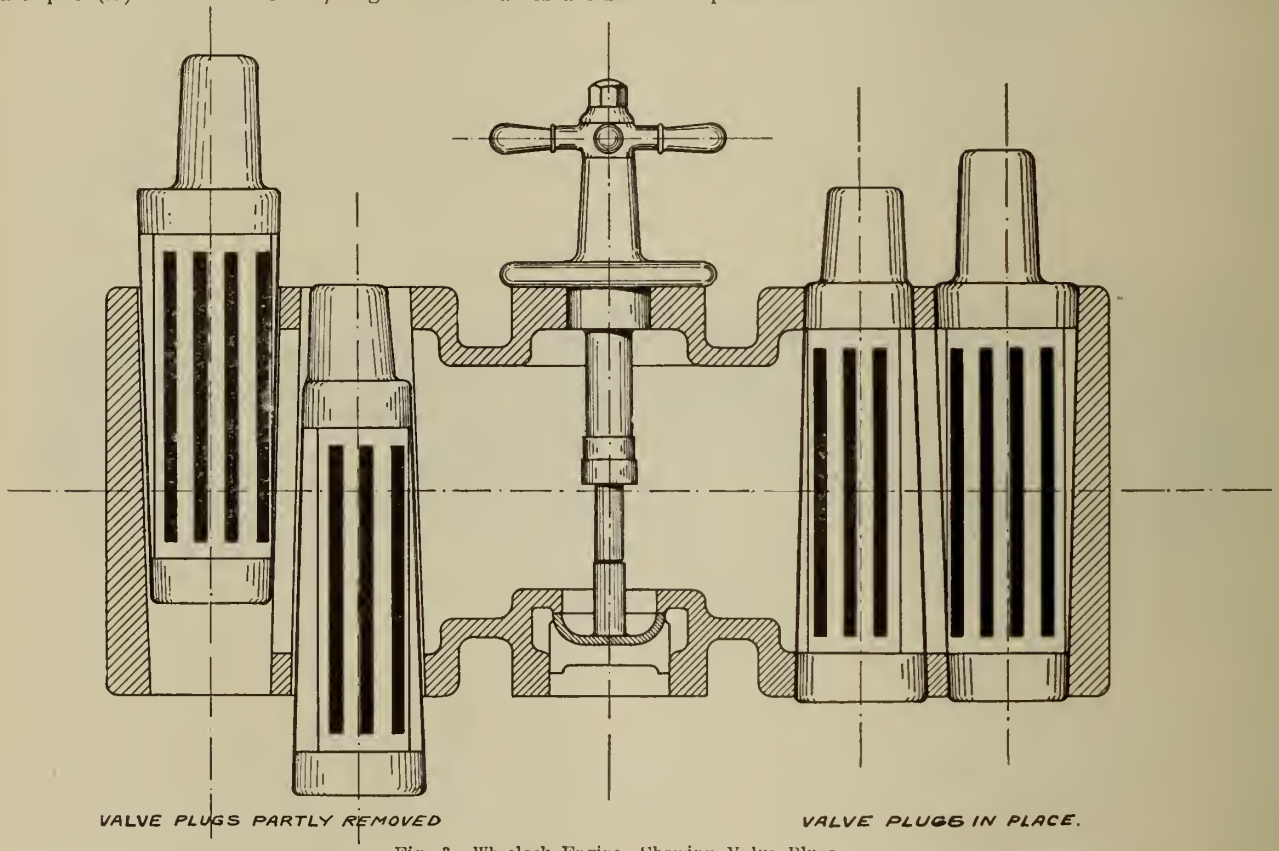



Fig. 3.—Wheelock Engine, Showing Valve Plugs.

The following are a few suggestions that operating engineers will find helpful in the operation of Wheelock engines.

### Oiling.

Never start the engine unless thoroughly oiled. See that the lubricator on steam pipe is working. Use nothing but the best mineral oil; animal oil is injurious to cylinder, as it contains more or less acid.

### Starting.

Never start engine until cylinder is well heated. To do this first open valve in small drip pipe under steam pipe. This will drain all the water out of steam pipe and warm cylinder ready for starting. After cylinder is thoroughly heated, raise the governor and put the small safety lever under bell crank. Then slightly open the throttle, raise the gab-hook and move valve motion back and forward not more than two or three times to make sure cylinder is free from water. Let engine start off slowly, and drop the gab-hook into position. Always start engine very slowly. After engine has got up speed, open throttle valve fully, and see that the safety lever is out from in under the governor.

Above instructions apply to non-condensing engines. When starting condensing engines, warm cylinder same as with non-condensing engine, then close vacuum brake, open injection valve, start condenser, and see that vacuum gauge registers at least 20 inches, then proceed to start same as with non-condensing engine.

### Stopping.

When stopping non-condensing engines, close the throttle and be careful to put safety lever under governor. When engine comes almost to a stand, lift the gab-hook, open throttle slightly, and stop crank in desired position by working valve motion with hand lever, then close throttle tight.

When stopping condensing engines, open vacuum break, close valve on injection pipe to condenser, allowing the vacuum to come back to zero on gauge. Not until this is done can you safely close

throttle. Next close the throttle and proceed as with non-condensing engines.

**Water in Cylinder.**

Do not under any circumstances allow water to get into the cylinder. There are various causes for this, such as allowing water to get too high in boiler, by allowing pockets in steam piping, and by not opening vacuum break of condenser before stopping.

**Packing.**

Do not allow piston packing to get too hard so as to cut the rod. Use fresh packing frequently.

**Lost Motion**

After taking up lost motion, do not forget to tighten the bolts and nuts. It is also well to go over foundation bolts occasionally and see that they are all tight.

**Tampering, Experimenting or "Trying."**

Never tamper with any part of engine unless you are thoroughly familiar with what you are doing. Do not do any "trying" or experimenting. Do not alter length of any of the rods, such as governor and eccentric rods. Do not work around governor while engine is running. Should you be forced to make any changes, always mark every part so you may put it back exactly where it was.

**Cleanliness.**

Keep all parts of engine clean, bright and free from dust, grease, etc. The point of cleanliness cannot be emphasized too strongly.

---

**NORTH BAY LODGE C.A.S.E.**

The first official meeting of the North Bay Lodge, No. 35, C.A.S.E., was held on June 9th, when the officers were installed by Bro. Chas. Mosley of Toronto. The meeting was held in the Ferguson Banquet Hall, offered for the occasion by the President of the Board of Trade, John Ferguson. There was a large attendance of members.

After the instalation of officers, Mr. Mosley gave a brief discourse on the usefulness and aims of the Canadian Association of Stationary Engineers, which was listened to attentively and appreciated by all present.

After hearty vote of thanks to Bro. Mosley for his attendance and instruction, the meeting adjourned to Charlie Winter's lunch parlors, where an excellent supper was enjoyed.

The officers elected are: President, W. J. Wilkinson; Vice.-Pres., W. Calloway; Rec.-Secy., J. J. McCaffery; Financial Secretary, N. S. Walsh; Treas., Ed. Carpenter; Conductor, A. Parks and Door Keeper, G. H. Steele. The trustees are J. S. Fulcher, W. H. Smith and J. G. Gagnon.

# Features and Capacities of Boiler Safety Valves

**The Points to take into Consideration when Calculating the Capacities of Valves of Various Types—Examples and Formulae are Given.**

By PETER BAIN, M.E.

A safety valve set to blow at a given pressure should automatically, when that pressure is on the point of being exceeded, at least take care of all further steam generation of which the evaporative power of the boiler is capable with the maximum fuel combustion on the fire grate, and otherwise the most severe conditions of service. No type of valve which although blowing, allows a steadily increasing and unlimited rise of pressure, fulfils its true purpose, although almost all permit to a lesser or greater extent some definite increase.

That this latter feature is not seriously important, particularly in cases where steam of high pressure is being generated, it is only necessary to state the British Board of Trade regulation bearing on the "Testing of Safety Valves." Generally speaking, its requirements for steam boilers and their equipment, are perhaps the most exacting of any in the world. They stipulate that the valves be tried under full steam and full firing for at least twenty minutes, with feed water shut off and stop valves closed, and that the increase of pressure must not exceed 10 per cent.

A safety valve therefore, to successfully operate under this test condition, throughout continuous and lengthened periods of exacting service should have in addition to correct disposition, arrangement and quality of minor details which ensure mechanical reliability, a capacity at least equal to the safety duty required.

**High Pressures.**

Reference has been made to steam of high pressure, the inference being that a safety valve fitted to a boiler working under this condition, is more favorably affected as far as accumulation of pressure is concerned, than if fitted to a boiler, under low steam pressure. That this is so, will be the idea aimed at, in the immediately succeeding remarks. In other words, it will be shown that while a safety valve must be proportioned to the fire grate, so that the discharge of excess steam be as rapid as the evaporation due to fuel combustion: the element of pressure of steam also plays an important part, and should be considered together with the fire grate area in the settlement of valve diameter, lift, etc. Irrespective of the fire grate area, the lower, the steam pressure, the larger the safety valve diameter and vice versa, assuming of course equal lift in each case.

The popular idea, unsupported by investigation, and based on a semi-instinctive awe of the real or imaginary risks of high pressure steam, inclines to quite the opposite view, viz. that higher pressures require correspondingly larger safety valves. That such a conclusion is not in accordance with fact, experience and experiment amply prove.

When steam flows through an opening with a square edge as in some safety valves, its flow is considerably reduced, and the weight of steam in lbs. discharged per second per sq. inch of opening, with the pressure not less than 25 lbs. absolute, corresponds very approximately to the Formula:

$$\frac{\text{Absolute Pressure} \times \text{Area of Opening.}}{70}$$

The area of opening necessary to discharge a given constant weight of steam, is in inverse ratio to the pressure; that is to say, it only requires an area of opening of half the amount to discharge a given weight of steam at 80 lbs. pressure, that would be required to discharge the same quantity, were the pressure only 40 lbs.

**Example.**

$$\text{Area of opening equals} \frac{\text{Weight of Steam per Sec.} \times 70}{\text{Absolute Pressure.}}$$

If weight of steam required to be discharged per second is assumed at 2 lbs. we have:

1st. Area of opening $= \frac{2 \times 70}{40} = 3.5$ square inches.

2nd. Area of opening $= \frac{2 \times 70}{80} = 1.75$ square inches.

showing the area of opening with the 80 lbs pressure to be exactly one half of that required at 40 lbs. pressure. As most safety valves have the valve seat at an angle of 45 deg. instead of square, the effective area of flow is reduced still further by about 30 per cent.

**Second Example.**

If $3\frac{1}{2}$ square inches area of opening is sufficient with square edge valve then for 45 deg. inclination it would be necessary to have

$$3.5 + \frac{3.5 \times 30}{100} = 4.55$$

sq. inches, in order to discharge the same weight of steam. In other words the effective opening with 45 deg. valve seat would be 70 per cent. of that with a square seat.

### Pop Safety Valve.

With pop safety valves the effective area is still less, due to the resistance offered the escaping steam by the lip above the valve seat. This lip feature in the pop safety valve ensures a higher lift than can be attained in the ordinary type, because the escaping steam reacts against it, and forces the valve higher.

The effective area of the pop type is taken as being 50 p.c. of the actual area due to the square rise or lift.

The total lift in standard types of valves has been found to vary as much as 300 per cent., a result of startling significance, in view of the fact that under a large number of existing official rules, they are equally rated in respect of relieving capacity.

Most rules relating to safety valves make the area or diameter of the valve the prime feature, and call only for a certain ample theoretical lift irrespective altogether of whether the valve actually attains to it or need so in practice. That the diameter or area of valve must be reckoned with, cannot be gainsayed, at the same time it is not the all important feature.

The actual lift of the valve on any diameter determines the quantity of steam which shall be allowed to escape in a given space of time, and is therefore paramount, because the ability to, at least, keep pace with the evaporative capacity, is thereon dependent.

### Results of Experiment.

A conclusion touching the foregoing observations and arrived at by the U. S. Board of Supervising Inspectors, as the result of experiments made a number of years ago, in the Navy Yard, Washington, was : That the diameter of a safety valve is not an infallible test of its efficiency, and that the lift which can be obtained in a safety valve, other conditions being equal, is a test of its effieiency.

With lifts varying from 1-32 to $\frac{1}{4}$ of the valve diameter in standard makes and sizes, and the apparent impossibility of 1 inch lift say on a 4 inch valve, irrespective of certain increased liability to accident with the latter excessive amount, it seems reasonable and logical that some more definite and reliable basis of arriving at the proper size of valve be adopted.

Elaborate experiments were recently made by Mr. Philip Darling, B.Se., for The Consolidated Safety Valve Co., New York, and much valuable light has been thrown on the subject, in addition to concise data in the form of rules for various services. These latter will be found at the end of this paper.

Briefly, his findings are, that valves of the same nominal size, and assumed therefore of equal capacity have in some cases only one third of the capacity of others.

That varying the assumed lift directly as the valve diameter, is excessive, it being clearly proved with a given design, that the lifts for different sizes are more nearly the same, the variation being much less rapid than that of the diameters. Also that the assumed actual lifts for large valves, were nearly double the actual average obtaining in practice.

The suggested basis for arriving at the proper safety valve equipment, is first of all to find the maximum evaporative capacity of the boiler, under its most severe requirement, and figures the valve capacity on the flow of steam principle, with constant modifications for different services.

The evaporation for different types of boiler is known within narrow limits, as the result of almost universal expert investigation, and may be computed as so many pounds of water evaporated per sq. feet of heating surface, or per pound of fuel burned on the fire grate, for a given period say per second, minute or hour.

### Valve Formulae.

Reverting again to the appended formulae, it should be noted that the constants applicable, embrace the lift and diameter feature, to the exclusion of the nominal valve area, and circumference of the nominal valve diameter multiplied by effective lift, in estimating the relief capacity.

Further note should be made of the transposed formula for valve diameter, that in a calculation resulting in say a value of 12, it would be necessary to use two or more valves, viz.: two at 6 inch, or three at 4 inch diam. respectively. The value of the constant at a maximum lift of .14 inch is 105, being certainly as suggested, quite a conservative figure to adopt.

As different types of boilers have usually services more or less exacting to perform and to withstand, it becomes necessary to suit their safety valve equipment as far as possible to these special conditions, with which end in view the deduced constants applicable are shown.

Reference was made in the early part of this paper, to a definite increase of pressure being admissable, and particularly with lever and weight valves unpreventable, owing to there being a gradual and slow lift before full capacity is reached in the latter. With ordinary spring valves, the action is quick and effective, and extremely so in the pop type.

For most purposes therefore, except probably for loco-boilers, the valve capacity if figured at the popping lift, will enable full steam pressure to be carried with a much lower per cent. of increase than that legally permitted, ensuring at same time less overstraining of the boiler.

Otherwise, and for loco-boilers with continually fluctuating loads, the existing 10 per cent. definite increase is probably preferable, especially if figured on a reduced capacity of the above amount, below the actual working pressure. It will lessen the severity of sudden violent blowing, each time stoppage is made, or the load in whole or part removed, by allowing a gradual rise to full capacity.

Perfection of this important steam boiler fitting, the safety valve, may not be just yet ; at the same time substantial progress is being made in the right direction towards its ultimate attainment, and the efforts of those aiming to bring the consummation about, in spite of much adverse criticism, deserve the appreciation of steam users and the public generally, as the ideal is, "Pro Bono Publico."

### Safety Valve Capacity Formulae.

For 45 degree valve seats,

(1) $E = 105 \times 1 \times P \times D$

or transposed

(2) $D = .0095 \dfrac{E}{1 \times P}$

### Modified Forms for Special Applications.

For locomotives.

(3) $D = .055 \dfrac{H}{1 \times P}$

For cylindrical multitubular; vertical and water tube stationary boilers.

(4) $D = .068 \dfrac{H}{1 \times P}$

For water tube, marine and Scotch marine boilers.

(5) $D = .095 \dfrac{H}{1 \times P}$

E=pounds of steam relieved per hour.
I=vertical lift of valve in inches.
P=steam pressure (absolute) lbs. per square inch.
D=nominal diameter of valve (inlet) in inches.
H=total boiler heating surface in square feet.

For flat-seated valves the constants in these formulae are as follows:

1=149.; 2=.0067; 3=.052· 4=.065; 5=.090.

# Causes and Cure for Water Hammer in Steam Pipes

Charles L. Hubbard Explains in the Metal Worker the Various Causes of Water Hammer, How to Locate the Trouble and Eliminate It.

Probably no one thing causes so much annoyance to both owner and steam fitter as snapping in the pipes or water hammer. That it is caused by improper drainage of the steam and return pipes is a well known fact, but to find the exact location of the difficulty, and even then to ascertain just why that particular part of the system does not drain as it should is often perplexing and at times impossible.

Sometimes the trouble is simply a slow surging of the water in certain pipes, while in other cases it varies from a slight snapping to sounds which are similar to those produced by a blow from a heavy hammer and accompanied by severe vibration of the pipe. The singing is caused by a slightly higher pressure in the pipe, on the boiler side, which tends to hold back the condensation at the extremity and thus causes the accumulation of water to surge back and forth in an effort to flow toward the boiler against this pressure.

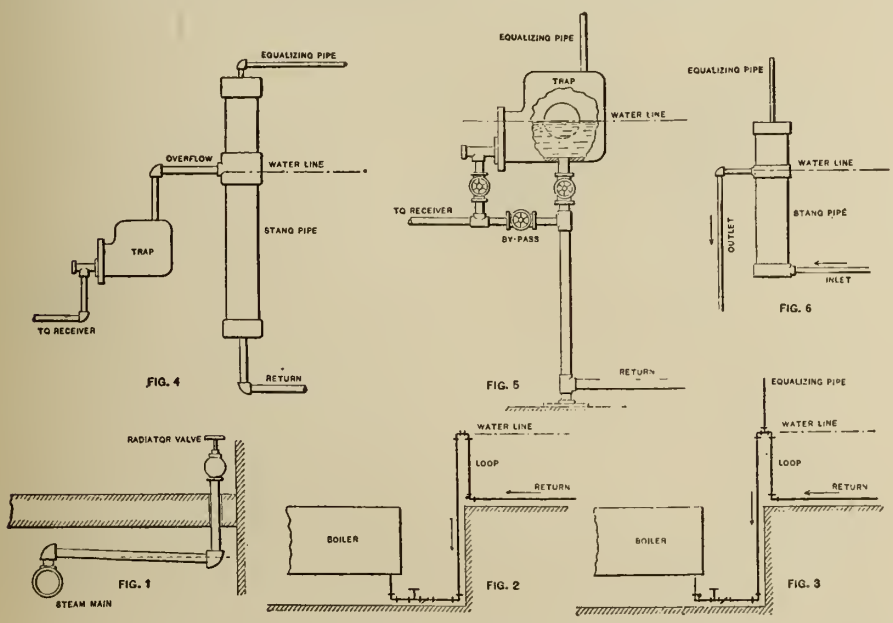
The snapping is caused by the hot steam coming in contact with more or less extended surfaces of cooler water which causes it to condense suddenly, and the steam rushing in to fill the vacuum thus formed causes the shock which follows. This is sometimes of sufficient force to rupture a fitting, and in the case of high pressure work especially, to result in serious damage.

When steam is first turned into a system of cold piping, the rapid condensation and unbalanced condition of the pressure within the system is bound to produce more or less water hammer for a short time, until the pipes become hot and an equilibrium is established; but this should not continue in any well constructed system of piping after it has had an opportunity to become warmed up. Persistent water hammer is a sign of poor design or faulty construction and no piece of work should be accepted by the owner until this has been remedied.

Water hammer often occurs in extended systems of piping operating under a low boiler pressure, as this is likely to fluctuate and thus unbalance the pressure in the system. Although such plants are much simplified by operating with a gravity return, they usually run more quietly when a moderate boiler pressure is carried and the steam is supplied through a reducing valve, which insures a constant pressure on the heating system at all times. This applies especially to buildings like cottage hospitals where there are long runs of piping and where quietness of operation is essential.

There are three points which, if carefully observed, will go far toward preventing water hammer in the average system, and these are sealing the return mains, giving a good pitch to the returns, which must necessarily be carried overhead, and avoiding connections allowing steam to enter returns which are under a slightly lower pressure due to their greater length, thus causing the condensation within them to be held back.

Fig. 1 shows a common cause of trouble in single pipe radiator work. A small pitch toward the foot of the riser causes water to collect in the bottom of the pipe, as shown by the dotted line. If this amount is small there will usually be only a slight singing and snapping, but in some cases this seems to produce a considerable condensation of steam at this point, causing a slight reduction in pressure which prevents the return water from the radiator from flowing back into the main. In cases of this kind the radiator gradually fills until a sufficient head is produced to force a portion of the water back against the steam pressure. Such a condition is accompanied by constant boiling and snapping as the steam is forced through this accumulation of water into the upper part of the radiator. It may be remedied by giving the connection a sharp pitch toward the steam main. A very slight pitch in the wrong direction will often cause the results described.




Causes and Cures for Water Hammer in Steam Pipes.

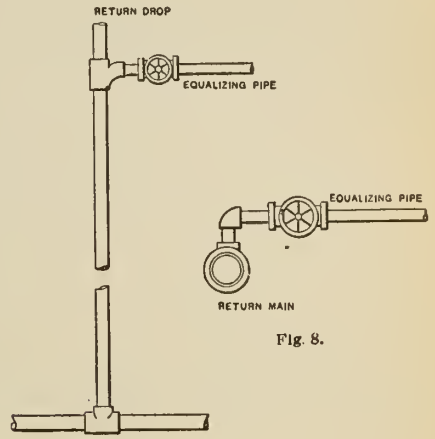



Fig. 8.

Fig. 7.

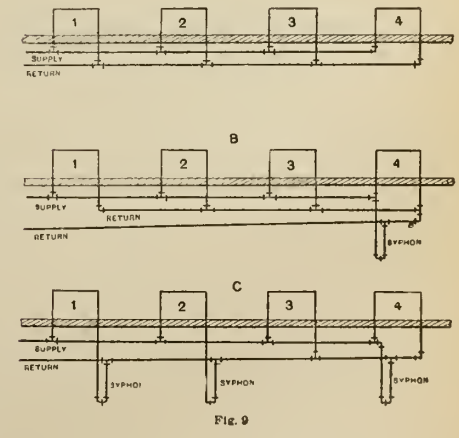



Fig. 9

Fig. 9 shows how the return from certain radiators may be "cut off," and also how this condition may be avoided. The arrangement in A is a more or less common one; a supply branch is run out to care for several radiators and an overhead return brought back, as shown. It is evident that the pressure reduces very slightly from one to four,

owing to the greater distance from the steam main ; hence the return from radiator 1 admits a pressure into the return slightly greater than that of No. 2, and No. 2 admits a pressure slightly greater than No. 3 and so on, thus producing a condition which tends to hold back the return water and cause singing and snapping near the end of the return line.

This can be avoided in two ways, as shown in B and C. In the former the extreme end of the return line starts with radiator No. 1, where it receives the highest pressure, the next lowest at No. 2, etc., thus reversing the conditions existing in A, so that the variation in pressure in the return line tends to force the water of condensation in the right direction instead of holding it back as in A. The end of the supply pipe in this case is dripped into the return through a water seal or siphon loop. This arrangement requires an extra line of pipe, but its more satisfactory operation is well worth the extra expense.

In C a single return line is used, but the first radiators are drained through siphon loops which seal the returns and prevent steam entering and holding back the water from the end of the line. These are only a few illustrations of the many conditions met with in practice, but serve to show what to avoid, in a general way, and it may be done in certain cases. The best prevention of water hammer is to seal the horizontal returns where it is possible to do so.

In the case of gravity return systems this is easily done by carrying them below the water level of the boiler. Sometimes it is not possible to do this on account of the boiler being placed at a lower level than the main basement in which the returns are carried. Figs 2 and 3 show improper ways which are sometimes used for establishing false water lines in cases of this kind. In Fig. 2, as soon as the horizontal return becomes filled with water and cuts off the steam supply from the loop a vacuum will be formed which draws the water up into it, thus forming a siphon which will drain the water out of the entire system and destroy the condition sought. Fig. 3, shows a method sometimes employed to break the siphon effect. This is all right in theory but seldom works satisfactorily in practice. This is because the steam in the equalizing pipe meets the cooler return water flowing over the top of the loop and is condensed so rapidly as to form a partial vacuum which will often draw the water out of the return mains as rapidly as the arrangement shown in Fig. 2.

A device supposed to overcome the faults of Fig. 3 is shown in Fig. 6. In this case a standpipe is substituted for a loop. The advantage of this is supposed to lie in the enlarged steam space above the water line, which is thought to reduce the condensation of steam entering through the equalizing pipe and so prevent the siphon effect. The writer has never happened to see one of these devices which worked satisfactorily. The overflow from the outlet constantly brings cooler water in contact with the steam and produces condensation and siphoning the same as in Fig. 3.

Fig. 4 shows the same arrangement of standpipe with the addition of a trap, for use when the condensation is discharged into a receiving tank instead of being returned to the boiler by gravity. The action of this is generally similar to that which takes place in Fig. 6. When the trap begins to discharge it usually sets up an agitation of the surface of the water in the standpipe, which in turn increases the condensation of steam above it, resulting in the old difficulty of siphoning and drainage.

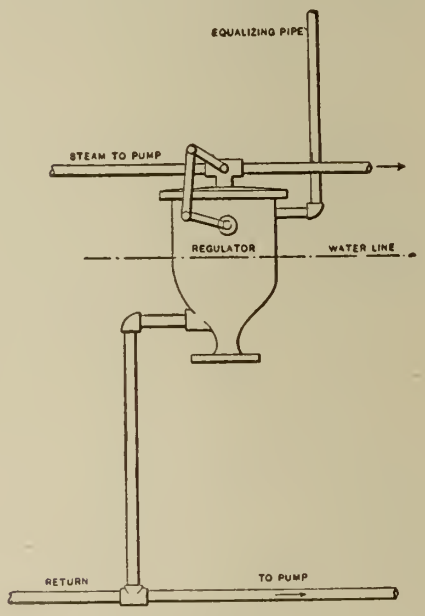


Fig. 10.

The arrangement shown in Fig 5 seems to overcome the difficulties mentioned better than any device which the writer has seen, although there are very likely others just as good. This may be used either with a gravity or pump return. It consists of a constant discharge float trap tapped to receive the return in the bottom and with an equalizing pipe connected into the top, as shown. It is provided with cutout valves and bypass for use when desired. The equalizing pipe should be 15 to 20 ft. in length, and connect with a return pipe which is always in use.

Figs. 7 and 8 show methods of connecting this pipe with a return drop and horizontal return respectively, the object being to make the connection so that no water will flow through it into the trap, it being desirable to keep the surface of the water in the trap as quiet as possible. In using this arrangement, open the valves and let the water in the trap rise to its normal level and the top fill with steam. Then close all valves, including the one in the equalizing pipe, and open the pet cock or air vent in the top of the trap. When the steam in the trap has condensed and the space, including the equalizing pipe, becomes filled with air, close the air vent and open the valves in the inlet and outlet of the trap, and then just "crack" the valve in the equalizing pipe sufficiently to admit steam pressure to the air contained in the upper part of the trap and a portion of the equalizing pipe.

By this arrangement the steam and water do not come in contact, being separated by an air cushion which transmits the pressure but prevents the rapid condensation with its resulting siphon effect. The inlet and outlet of the trap both being near the bottom, the surface of the water is not disturbed to any extent. Sometimes, for reasons which are not easily discovered, steam will gradually displace the air in the trap and cause flooding and siphoning, as in the case of a standpipe. In such cases the upper part of the trap may be filled with air and the valve in the equalizing pipe left closed. This will produce the desired result almost without fail, the confined air acting as an elastic cushion to maintain a pressure in the trap. After this device is once put in operation no further attention is usually required.

Fig. 10 shows an arrangement for maintaining a water seal by the use of a pump regulator set at the desired elevation and connected as shown. In this case no receiving tank or trap is used, the return water flowing directly to the pumps under pressure. This method works well when the whole system is operated under one pressure. If there are drips from several pressures the returns should be separately trapped into a vented receiver and the main returns sealed by the method shown in Fig. 5.

---

The present methods of wiring a building were criticized in a paper recently read before the Glasgow section of the British Institute of Electrical Engineering. The introduction of metal filament lamps leads to the expectation that lower voltages will be used for the wiring of buildings, thus making possible a cheaper system of installing the circuits. It was suggested that a metal-covered cable should be invented which shall be soft enough to be rolled up into coils for delivery and to be unwound and straightened for use in the building. The metal covering could be used as the neutral wire, or in isolated work as the return line.

# Smokeless Combustion of Coal in Boiler Plants

**The U. S. Geological Survey, Technology Branch, in a Study of the Question by D. T. Randall and H. W. Weeks, Show that Bituminous Coal, High in Volatile Matter, can be Burned without Smoke.**

A consideration of the problem of burning coal without smoke shows that proper equipment, efficient labor, and intelligent supervision are necessary.

The problem is very important because of the advantages of smokeless combustion both in public buildings and on naval vessels. In addition, smoke abatement is a factor in conserving the fuel resources. As a part of its general investigation of the best methods of utilizing coal, the U. S. Geological Survey has made extended tests to determine the conditions necessary for the smokeless combustion of bituminous coal in boiler plants.

The general conclusions of Messrs. Randall and Weeks are as follows :— Smoke prevention is possible. There are many types of furnaces and stokers that are operated smokelessly. Credit is to be given to any one kind of apparatus only in so far as the manufacturers require that it shall be so set under boilers that the principles of combustion are respected. The value of this requirement to the average purchaser lies in the fact that he is thus reasonably certain of good installation. A good stoker of furnace poorly set is of less value than a poor stoker of furnace well set. Good installation of furnace equipment is necessary for smoke prevention.

Stokers of furnaces must be set so that combustion will be complete before the gases strike the heating surface of the boiler. When partly burned gases at a temperature of, say, 2,500 deg. F., strike the tubes of a boiler at, say, 350 deg. F., combustion is necessarily hindered and may be entirely arrested. The length of time required for the gases to pass from the coal to the heating surface probably averages considerably less than one second, a fact which shows that the gases and air must be intimately mixed when large volumes of gas are distilled, as at times of hand firing, or the gas must be distilled uniformly, as in a mechanical stoker. By adding mixing structures to a mechanical stoker equipment both the amount of air required for combustion and the distance from the grates to the heating surface may be reduced for the same capacity developed. The necessary air supply can also be reduced by increasing the rate of combustion.

No one type of stoker is equally valuable for burning all kinds of coal. The plant which has an equipment properly designed to burn the cheapest coal available will evaporate water at the least cost.

Although hand-fired furnaces can be operated without objectionable smoke, the fireman is so variable a factor that the ultimate solution of the problem depends on the mechanical stoker; in other words, the personal element must be eliminated. There is no hand-fired furnace from which, under average conditions, as good results can be obtained as from many different patterns of mechanical stoker, and of two equipments the one which will require the less attention from the fireman gives the better results. The most economical hand-fired plants are those that approach most nearly to the continuous feed of the mechanical stoker.

The small plant is no longer dependent on hand-fired furnaces, as certain types of mechanical stokers can be installed under a guaranty of high economy, with reduction of labor for the fireman. In short, smoke prevention is both possible and economical.

### Tests Made.

During 1904 to 1906 coals from all parts of the United States were burned at the Government Fuel Testing Plant at St. Louis, in furnaces which were in the main of the same design. Most of the tests were made on a hand-fired furnace under a Heine water-tube boiler. The lower row of tubes of the boiler supported a tile roof for the furnace, giving the gas from the coal a travel of about twelve feet before coming into contact with the boiler surface. This furnace is more favorable to complete combustion than those installed in the average plant. A number of coals were burned in this furnace with little or no smoke, but many coals could not be burned without making smoke that would violate a reasonable city ordinance when the boiler was run at or above its normal rated capacity.

In 1907, the steaming section of the St. Louis plant was moved to Norfolk, Va., where subsequent tests of this nature were made. The plant at Norfolk was equipped with two furnaces—one fired by hand and the other by a mechanical stoker.

In the course of the steaming tests some special smoke tests were made and the influence of various features in smoke production was noted. As the tests were made as far as possible under standard conditions with a minimum variation in boiler room labor the results bring out the importance of other factors such as character of fuel and furnace design.

### Conclusions of Test.

A brief summary of the general conclusion is as follows : A well designed and operated furnace will burn many coals without smoke, up to a certain number of pounds per hour, the rate varying with different coals, depending on their chemical composition. If more than this amount is burned, the efficiency will decrease and smoke will be made, owing to the lack of furnace capacity to supply air and mix gases.

High volatile matter in the coal gives low efficiency and vice versa. The highest efficiency was obtained when the furnace was run at low capacity. When the furnace was forced the efficiency decreased.

With a hand-fired furnace the best results were obtained when firing was done most frequently, with the smallest charge. Small sizes of coal burned with less smoke than large sizes, but developed lower capacities. Peat, lignite, and sub-bituminous coal burned readily in the type of tile-roofed furnace used and developed the rated capacity with practically no smoke. Coals which smoked badly gave efficiencies 3 to 5 per cent lower than the coals burning with little smoke.

Briquets were found to be an excellent form for using slack coal in a hand-fired plant. They can be burned at a fairly rapid rate of combustion with good efficiency and with practically no smoke. High-volatile coals are perhaps as valuable when briquetted as low-volatile coals.

### Coal Tests.

A comparison of tests on the same coal washed and unwashed showed that under the same conditions the washed coal burned much more rapidly than the raw coal, thus developing high rated capacities. In the average hand-fired furnace washed coal burns with lower efficiency and makes more smoke than raw coal. Moreover, washed coal offers a means of running at high capacity, with good efficiency, in a well-designed furnace.

Forced draft did not burn coal any more efficiently than natural draft. It supplied enough air for high rates for combustion, but as the capacity of the boiler increased the efficiency decreased and the percentage of black smoke increased.

Most coals that do not clinker excessively can be burned with 1 to 5 per cent. greater efficiency and with a smaller percentage of black smoke on a rocking grate than on a flat grate. Air admitted freely at firing and for a short period thereafter increases efficiency and reduces smoke.

As the CO in the fuel increases the black smoke increases; the percentage of CO in the flue gas is therefore, in general, a good guide to efficient operation. However, owing to the difficulty of determining this factor, combustion cannot be regulated by it.

The simplest guide to good operation is pounds of coal burned per square foot of grate surface per hour. None of the problems of combustion have received more experimental treatment than the burning of coal in hand-fired furnaces. Hundreds of devices for smokeless combustion have been patented but almost without exception they have proved failures. This record may be explained by the fact that many of the patentees have been unfamiliar with all the difficulties to be overcome, or have begun at the wrong end. Numerous patents cover such processes as causing the waste gases to re-enter the furnace, and schemes for collecting and burning the soot are legion. So many manufacturers who have been looking for some cheap addition to a poorly constructed furnace to make it smokeless have experienced inevitable failure that the work of educating the public to rid cities of the smoke nuisance has been hard, long, and only partly successful.

The total number of steam plants having boilers fired by hand is far greater than the total of plants with mechanical stokers, but if the comparison is based on total horsepower developed the figures show less difference. Particularly is this true in sections of the Central West, where mechanical stokers are generally used at large plants. As a general rule, hand-fired plants do not have proper furnaces, and methods of operation are far from conducive to good combustion. Coal is usually fired in large quantities, and little opportunity is given for the air and gases to mix before the heating surface is reached and combustion is arrested. In all the hand-fired plants visited success in smoke prevention has been obtained chiefly by careful firing. The coal was thrown on often in small quantities; the fire was kept clean, enough ash to prevent the passage of air through the fire never being allowed to collect on the grate; and more air was supplied at firing than after the volatile matter had been distilled. Even with such precautions the plants might have made objectionable smoke at times but for the fact that usually some method was employed for mixing the gases and air before they reached the heating surface.

### General Conclusions.

The flame and the distilled gases should not be allowed to come into contact with the boiler surfaces until combustion is complete.

Fire-brick furnaces of sufficient length and a continuous or nearly continuous supply of coal and air to the fire make it possible to burn most coals efficiently and without smoke.

Coals containing a large percentage of tar and heavy hydro-carbons are difficult to burn without smoke and require special furnaces and more than ordinary care in firing.

Briquets are suitable for use under power plant conditions when burned in a reasonably good furnace at the temperatures at which such furnaces are usually operated. In such furnaces briquets generally give better results than the same coal burned raw.

In ordinary boiler furnaces only coals high in fixed carbon can be burned without smoke, except by expert firemen using more than ordinary care in firing.

Combinations of boiler room equipment suitable for nearly all power-plant conditions can be selected, and can be operated without objectionable smoke when reasonable care is exercised.

Of the existing plants some can be remodeled to advantage. Others can not, but must continue to burn coals high in fixed carbon or to burn other coals with inefficient results, accompanied by more or less annoyance from smoke. In these cases a new, well-designed plant is the only solution of the difficulty.

Large plants are for obvious reasons usually operated more economically than small ones, and the increasing growth of central plants offers a solution of the problem of procuring heat and power at a reasonable price and without annoyance from smoke.

The increasing use of coke from by-product coke plants in sections where soft coal was previously used, the use of gas for domestic purposes, and the purchase of heat from a central plant in business and residence sections all have their influence in making possible a clean and comfortable city.

---

## DEFINITION OF HEAD OF WATER.

In a recent paper, Chas. T. Main, mill engineer and architect, of Boston, gives the following definition of "head" as applied in water power development:—

"There is the legal head, or the head to which the owner has a right to develop his power. This may or may not have been developed to its full extent. It may be that the expense involved would be too great to warrant further development. In some cases it may be economy to make the expenditure necessary to get the benefit of some unused portion of the head.

"The gross head is the head actually used for producing power and getting the water to and away from the wheel.

"The net effective head is the gross head minus the loss in head required to get the water to and away from the wheel. This loss will vary with the length of the waterways leading to and away from the wheels, the velocity of the flowing water, and the construction of such waterways.

"In several manufacturing cities where the water power is controlled by a company which is separate from the mill owners, there is an allowance of one foot made from the gross head before charging for the water as used on the wheels.

"The head should be measured with the wheels running. The only portion of the head which produces power is the difference in level directly above and below the wheel when the wheel is running."

---

## FLAT vs. PISTON VALVES.

A series of engine tests recently reported by Mr. F. W. Dean, mill engineer and architect, Boston, presents excellent opportunity for comparing the economy of engines fitted with flat or with piston valves. The simple engines in the series ranged from 12 x 18 to 16 x 15 in cylinder dimensions. All were of the high speed type, and were direct connected to electric generators. All had run for relatively long periods before the tests were made.

Comparison shows that if the load is not considered, the most economical result was obtained with a piston valve engine. This result was, however, obtained when the engine was heavily loaded. But with such lighter loads as were comparable the economy of the flat surpassed that of the piston valve. Moreover, the flat valve engine gave a flatter load curve than the piston valve, which is a valuable feature. The most economical results were obtained from an engine which had a flat valve with provision for automatically taking up wear.

On the whole Mr. Dean is led to believe that the flat are more economical than the piston valve engines, if the valves are self adjusting with wear, and are of a good design. They must have less port surface and less clearance, and can be made to adjust themselves for more wear than piston valves.

The performances of perfectly balanced flat valve engines appear to be so relatively poor that it seems to disqualify them, unless this type of valve can be made with some mechanism by which wear will not increase leakage.

# The 19th Convention of the Canadian Electrical Association

## Held in Quebec June 16th, 17th, 18th—Many Interesting and Important Papers Read—The Delegates were Royally Entertained--Details of the Convention.

When Quebec was settled upon as the place for this year's convention, it was thought by many that the location was not central enough for a good attendance. The last issue of the daily register showed that they were mistaken. The number registered was 162, which was highly satisfactory although not so many as at the last year.

The fact that the convention was held in Quebec brought quite a number from the Maritime Provinces, who would have been unable to attend had the meetings been held farther west.

The many varied and historical places in and about Quebec more than repaid the visit to the ancient city. It was here that civilization first began to conquer savagery in this new northern land ; it was here the battle grounds on which the best blood of Old England and Old France met in deadly conflict and decided the fate of half a continent ; around and about here every scene is hallowed by three centuries of the most romantic and tragic history that the new world knows.

The majority of the delegates no doubt have carried away the same impression as did Charles Dickens, which is expressed in his words : "The impression made upon the visitor by this Gibraltar of America, its giddy heights, its citadel suspended, as it were, in air ; its picturesque steep streets and frowning gateways, and the splendid views which burst upon the eye at every turn is at once unique and lasting, and make it a place not to be forgotten."

The headquarters of the convention were made at the Chateau Frontenac. The management of this perfect hotel left nothing undone to make the stay of the members as pleasant as possible. The meetings were held in the "Red Room," which was turned into a comfortable little auditorium. The position of the Chateau with its magnificent views makes an ideal spot for the headquarters of any convention.

### Wednesday Morning.

The opening meeting was called to order by the president, W. N. Ryerson, who introduced Sir George Garneau, K.C.M.G., the mayor of Quebec. His Worship, in an appropriate speech, welcomed the association to Quebec, expressing the hope that the time would not be entirely devoted to business, and that a good deal of pleasure would be interspersed. He called attention to the vast possibilities of electrical development in the vicinity of Quebec, owing to the large number of available waterways. On the close of his talk His Worship was given a hearty, standing vote of thanks.

After the minutes of the last convention were read and confirmed the President delivered his address. In his opening remarks he touched upon the depression that electrical industries had recently passed through and cited a falling off of 54 per cent. in the building of electric railways. In 1907 there had been 72.27 miles constructed, while the corresponding figure for 1908 had been but 32.94.

The fact that Western Ontario was about to be supplied with electrical

W. N. RYERSON
President Canadian Electrical Association.

energy generated at Niagara Falls was touched upon, and attention drawn to the treaty between the governments of Canada and the United States regulating the use of Niagara power by the two countries.

"The North American Conservation Conference held in Washington, D.C., during the month of February of this year was participated in by a Canadian Commission consisting of Hon. Sydney Fisher, M.P., minister of Agriculture, Hon. Clifford Sifton, M.P., and H. S. Beland, M.D., M.P.

"The 'Declaration of Principles' drawn up at this conference contains the following significant passages relative to the use of water power :

" 'We recognize as natural resources all materials available for the use of man as means of life and welfare, including those on the surface of the earth, like the soil and the waters ; those below the surface, like the minerals, and those above the surface, like the forests. We agree that those resources which are necessaries of life shall be regarded as public utilities, that their ownership entails specific duties to the public, and that, as far as possible, effective measures should be adopted to guard against monopoly.

" 'We recognize the waters as a primary resource and we regard their use for domestic and municipal supply, irrigation, navigation and power, as inter-related public uses and properly subject to public control. We therefore favor the complete and concurrent development of the streams and their sources for every useful purpose to which they may be put.

" 'We regard the monopoly of waters and especially the monopoly of water power, as peculiarly threatening. No rights to the use of water powers in streams should hereafter be granted in perpetuity. Each grant should be conditional upon prompt development, continued beneficial use, and the payment to the public for the rights enjoyed, and should be for a definite period only. Such period should be no longer than is required for reasonable safety of investment. The public authority should retain the right to re-adjust at stated periods the compensation to the public and to regulate the rates charged to the end that undue profit or extortion may be prevented.' "

Regarding this latter phase Mr. Ryerson drew attention to the fact that the question of rate regulation was being talked of in Canada and that the Railway Commission is investigating the telephone and telegraph rates with a view to re-adjustment.

He urged that the association should take some action towards having a representative present at the convention of the Underwriters National Electric Association. "The electrical men of Canada should have some voice in the making of the Underwriters' rules and it will, without doubt, be found that any earnest suggestion from them will receive respectful consideration on the part of the Underwriters."

The report of the secretary-treasurer which was read by Mr. T. S. Young, showed that : "Sixty-one new members joined the association during the year,

eighteen members resigned, and seventeen names were removed from the membership roll for non-payment of dues and other causes. The present membership is 121, an increase of 26 as compared with one year ago."

The finances were shown to be in good condition and the life of the association in a healthy state.

### Report of Committee on Meter Inspection Fees.

This was read by A. A. Dion, Ottawa, chairman, and explained what had been done regarding the reduction of these fees. The progress made in this matter has been very satisfactory.

"He (the Minister of Inland Revenue) said that on July 1st next, reductions would be made in the verification fees of both electric and gas meters, which reductions would aggregate $10,000 in a year, and that when reasonable time had elapsed so that the cost of the service with all improvements would be definitely known, further reductions would be made in order that the receipts should as nearly as possible balance the expenditure."

### Report on the Grounding of Transformer Secondaries.

In the absence of R. S. Kelsch, the chairman of this committee, the report was read by the president and invoked considerable discussion on this topic of transformer grounds, which is one of considerable importance to all electrical men.

The committee recommended using the water mains wherever this is possible, but where there are no water mains or the authorities will not permit of their use the following suggestions for obtaining a ground connection were offered :

"When the water pipe is used, be sure that the ground clamp used to connect to the water pipe is of sufficient strength to permit making a good tight connection ; also that the bolt used for clamping is not a common iron bolt which will rust off and allow the connection to become loose.

"Use a one-inch galvanized iron pipe and drive deep enough to be absolutely sure that several feet of the pipe are in moist earth at all times. It is good practice to have the pipe of sufficient length to extend six or seven feet above the ground as the pipe can be stapled in place with heavy staples and will be less liable to damage from a wagon wheel or a mischievous boy, than would be the ground wire itself. Special pains should be taken to see that the ground wire connection to the pipe is absolutely perfect, both mechanically and electrically, so that the driving of the pipe will not disturb the connection.

"If either of the above methods cannot be employed and it is necessary to make a ground by deep excavation and ground plate, it is recommended that the ground plate should consist of a No. 16 Stubbs gauge copper plate, tinned on both sides and at least 3 feet square. The ground wire connection to be made with extra care, both with respect to mechanical and electrical contact. The plate should be buried in fine crushed coke, having at least two feet of coke both over and under the plate. A cast iron plate one-half inch thick, of the same dimensions may be used if desired.

"To make the joint to a cast iron plate, it is recommended that a copper plug be employed, to be screwed into the plate, with the ground wire soldered

P. S. COATE
First Vice-President C. E. A.

to the plug and the whole thoroughly painted with some heavy asphalt compound to prevent corrosion between the plug and the plate."

The committee further recommended that the following resolution be presented to the Canadian Fire Underwriters' Association :—

"Resolved that the Canadian Fire Underwriters' Association change the rule relating to the grounding of alternating current secondary circuits, making mandatory the grounding of all alternating current secondary circuits having a pressure of 150 volts or less, and that, wherever possible, the ground be made to the water mains which is the safest method of making a ground connection, and which will in no way injure the water pipes, as electrolysis is not present with alternating currents."

The reading of this report caused a good deal of interesting discussion on the subject of grounding transformers. It was agreed that some sort of a mandatory agreement should be reached. This would materially assist in cases arising out of suits brought on by accidents. If there could be some enactment or some resolution of an agreement this could be used as a reference or authority in such cases which would eliminate a good deal of the trouble and expense now experienced.

After this discussion numerous letters and telegrams of regret from members and guests unable to attend were read, and as there was no general business, the reading of the papers was proceeded with.

The first paper was the one on "Synchronous Motors Used for Power Factor Correction," by B. T. McCormick. In the absence of the author this paper was read by G. R. Cole and invoked considerable discussion.

### Wednesday Afternoon.

The afternoon was devoted to the reading of four papers and their discussion. As L. W. Pratt was not on hand, his paper on "Power Rates for Central Stations" was read by A. L. Mudge. This was not discussed until after the reading of S. C. Doane's paper on "The Conservation of our Natural Resources Through the Use of High Efficiency Lamps."

Mr. Doane said in conclusion : "Many systems could be built around this fundamental idea of fixed charges for fixed expenses. This idea itself, however, should be clearly recognized and approved by this association as the fundamental basis for any rate schedule sufficiently flexible to meet the conditions created by the highly-efficient lamps of the future. Once become thoroughly imbued with the principle of fixed charges for fixed expenses, and you will be in a position to combat logically the present tendency of city councils, public service commissions and legislatures to fix limiting rates on the kilowatt-hour basis for lighting and other service. Thus you will become the pioneers in opening a way to a realization of that enormous fuel conservation which the high efficiency lamp makes possibly."

The paper on "The Small Central Station and its Practical Management," by R. J. Smith, came next and set forth concisely what the manager of a small plant can do, by hustling, to increase his number of customers.

The last paper was the one on "Accounting for Electrical Companies," by

R. F. Pack. After a short discussion on this the meeting adjourned.

**Wednesday Evening.**

At eight o'clock the convention visitors were treated to a ride through Quebec on the electric cars, and were well taken care of by H. M. Bartlett, the genial superintendent of the Quebec Railway, Light and Power Co.

During the afternoon, while the men folks were in session the ladies were taken across the river by ferry and enjoyed a picturesque ride through Levis by the courtesy of the Levis County Railway.

**Thursday Morning.**

The papers taken up at this meeting were "Electrolytic Lightening Arresters," L. A. Herdt and J. Dalemont; "Considerations Affecting the Choice of Type in Transformers," by G. Percy Cole; "Questions, Answers and Topical Discussion of Business Getting," by E. J. Phillip, H. O. Fisk and E. A. Evans.

**Thursday Afternoon.**

At 1.30 p.m. the cars of the Quebec Ry., L. & P. Co. were again placed at the disposal of the convention and a trip was made to the C.P.R. docks where, by invitation of the company, a visit was made on the Royal Mail Steamship, "Empress of Britain." This palatial boat was thrown open from stem to stern for inspection. Fire parade and collision drill were witnessed by the visitors and afternoon tea was served in the beautiful main saloon.

The executive board met on the return to the hotel and the following officers for the ensuing year were elected: President, W. N. Ryerson, general manager Great Northern Power Co., Duluth, Minn., this is the first time in the history of the association that a president has been re-elected for a second term; 1st vice-president, P. S. Coate, manager Chatham Gas Co., Chatham, Ont.; 2nd vice-president, E. A. Evans, general manager Quebec Railway, Light and Power Co., Quebec; secretary-treasurer, T. S. Young, Confederation Life Building, Toronto; managing committee, R. S. Kelsch, Montreal; R. G. Black, Toronto; A. A. Dion, Ottawa; J. J. Wright, Toronto; H. O. Fisk, Peterboro, were all re-elected and the new members of the committee are R. J. Smith, Perth, Ont.; F. A. Chisolm, St. Johns, Que.; W. L. McFarlane, Cornwall, Ont.; W. L. Adams, Niagara Falls, Ont.; A. L. Mudge, Toronto. The location of the next convention was left in the hands of the committee.

**Thursday Evening.**

In spite of the rain there were very few indeed who did not take advantgge of the invitation of the Quebec Railway, Light and Power Co., to a dinner at the old Kent House at Montmorency Falls. A special train conveyed the guests to this interesting spot and about 175 people sat down to the dinner, which was served in the old original ball room of the house, which has been unaltered all these years.

It was intended to have had a special performance in the rustic theatre after dinner, but this was cancelled on account of the rain, the theatre being an open air one. The performance was little missed as an impromptu programme of songs and recitations was gotten up on the spur of the moment by those present. Those taking part were Mrs. Henderson, G. C. Rough, R. J. Hiller, C. C. Starr, "The Professor," and Mr. Webber, purser of the "Empress of Britain." The evening was appropriately ended by an informal dance before the guests left for Quebec on their special train.

E. A. EVANS

Second Vice-President C. E. A.

During the speech making and toasts, E. A. Evans touched on the history of the old house in which those present were enjoying themselves and under his graphic guidance one could almost see the fine old gentlemen and ladies of long ago partaking of perhaps a similar dinner with the light of huge long candles glittering on the powdered hair and flashing jewels, buckles and swords of the olden fashions.

The house was built in 1779, one hundred and thirty years ago, by Governor Haldimand, and when the Duke of Kent, father of Queen Victoria, came out to Canada in 1791 he made Haldimand House (as 'twas called then) his summer resort.

**Friday Morning.**

The main paper of the morning was that by Wm. P. Flint on "Gas Engines and Plants," which was well illustrated by lantern slides and invoked considerable discussion. E. P. Heaton read a paper on "Insurers and Insured: Illusions and Delusions," which was also well discussed. In fact, one of the features of the convention was the interested discussions which took place on all the papers and which, after all, is the most important part of such conventions. The business session closed with the naming of standing committees and the taking up of unfinished business.

**Friday Afternoon.**

The Canadian Government kindly placed at the disposal of the convention the ice-breaker "Montcalm" which took the party down the river to where the "Campania" had run aground the day before. Despite the wintry weather everyone seemed to be enjoying themselves, from the "man in the crow's nest" down. Those on board who were interested, were given an exhibition of the wireless telegraphy apparatus with which the ship is equipped. With the usual hospitality, refreshments were served in the saloon.

Too much cannot be said in praise of the manner in which the local committee and the people of Quebec (where concerned) looked after the entertainment of the visitors. There wasn't a lagging moment throughout the three days, the only regrettable part being the reluctance of the weather man in furnishing decent weather. However, those in attendance showed their contempt of his treatment by simply ignoring him and having a good time anyway.

---

Rust joints are frequently required, and the following mixtures may be used: For quick setting mix one pound of powdered sal ammoniac, two pounds of flour of sulphur, 80 pounds of iron borings with water to the consisteney of paste; for slow setting mix two pounds of sal ammoniac, one pound of sulphur, 200 pounds of iron borings with water to the consistency of paste. A slow setting rust joint is to be preferred if the joint is not to be used at once.

---

In order to permit of using tungsten lamps of low voltage in illuminated signs, a special type of transformer has been designed, which reduces the voltage in the ratio of 10 to 1. With a view to preventing loss of current in a flashing sign, these transformers are controlled through the primary circuit.

# Small Central Station; Its Practical Management *

## Manager of Small Plant Must be a Business Man—Practical Methods for Handling of Complaints, and Obtaining Good Service.

By R. J. SMITH **

It is not the intention of the writer of this paper to treat the designing or management of a hydro-electric generating station and distributing system in a general way, because that has been done over and over again, but rather to touch on some matters of detail which must be handled every day by the small central station manager.

In plants located in towns with populations of from ten thousand or less, the manager must be familiar with every detail of his business. He must be he, not only his own engineer, but his own solicitor, also, and in a great many cases lacks a technical education, which does not tend to smooth his difficulties any. It is easy for a big company with plenty of help and loads of measuring instruments, to run everything fine, but the manager of a small plant is hindered every way by lack of apparatus to make tests, help etc.

First of all, he must know what his product is costing him to produce and make his rates accordingly, taking into consideration the limited market he has to work in.

### 24-hour Service, Pays.

The next question which may be asked is, "Will a 24-hour service pay in a small town?" The writer is of the opinion that it will, or rather that it can be made to pay. There is scarcely any small town in which a very fair day-load cannot be secured. If the average man can be shown that it is possible to cut his expenses down, or decrease his manufacturing costs by the use of electric motors, there will be no difficulty in securing his business. Then there are fan motors, electric heating devices, such as smoothing irons and domestic cooking utensils, which are now being placed on the market in a very high state of efficiency and at a moderate cost.

The writer is operating two motors of 56 and 100 k.w. capacity direct-connected to turbine pumps, which supply water to the Perth Waterworks. The 56-k.w. motor is operated continuously, pumping directly into the water main. The 100-k.w. motor is used for fire purposes only. Almost all small towns have a system of waterworks, and there is no reason why the central station manager cannot secure a very good contract operating turbine waterworks pumps. They are the ideal pumps for such service, whether pumping direct, or into an elevated tank or reservoir. They are now designed for direct connection to either induction or synchronous motors and work very satisfactorily. If an elevated tank or reservoir is used, the pumping may be done during the hours of light load.

### A Good Service Important.

Every manager must provide a good and reliable service continuous and free from interruption, before he can hope to build up a substantial business. Customers' installations must be looked after by the manager to insure their being properly made and maintained. It pays to study every installation, giving the prospective customer the very best advice as to the distribution or arrangement of his lighting. There is no advertisement so cheap and good as a satisfied customer. Above all, create confidence, for confidence is the foundation of new business. The average customer knows nothing at all about electricity or illuminating engineering, and cares only for results. What he wants is the best possible service for the least cost. Who should he look to for advice in the small town, if not to the central station manager?

The writer believes that there is no town too small for a display room. In it there should be a small, well selected stock of fixtures, shades, heating and cooking utensils, which can be demonstrated and explained to customers when paying accounts. Many sales will be made in this way without additional cost. It should be the policy of the company to supply customers with fixtures, shades etc., at a slight increase on cost, in order to encourage electric lighting. Smoothing irons and cooking utensils should be supplied to customers on 30 days' free trial. If they find that they can get along without them at the end of thirty days, leave them for 30 days more. In nine out of every ten cases you will make a sale. The writer has customers whose meter accounts for the months July and August read higher than for December and January on account of the use of smoothing irons, cooking utensils, etc. Current is sold during the day at lighting rates.

It is a good plan to have a meter connected to a bank of lamps in your display room, so that you may explain the operation of the meter to dissatisfied customers. If he sees a meter go slowly on a small candle-power lamp revolve faster on a number of lamps, and stop when the lamps are turned off, he has a great deal more confidence in the instrument than before it was explained to him. The meter has lost its air of mystry, he know just how it works and goes away satisfied.

### Complaints.

Every complaint should be immediately and thoroughly investigated by the manager, personally, and in many cases they will be traced to a misunderstanding, which is easily rectified. A special effort should be made to have the customer leave the office in a better state of mind than when he entered, and feeling that he is getting the "square deal" which he is entitled to.

It is the writer's opinion that for a small station it is much better to use only one type and make of meter, and become thoroughly familiar with it, rather than use several types and not know any of them thoroughly. Meter readers are less liable to make mistakes when they have only one style of dial to deal with. Testing and repairs are much easier handled when only one type is used. The writer uses a rotating standard for testing and finds it very convenient. By this method variations in load and voltage may be neglected as both meters are affected alike. Since there are no indicating instruments to read, or stop-watch to be used in timing meter under test, it is possible for one man to do the work which would necessitate two men using indicating instruments. With one type of meter in use it is only necessary to have one rotating standard of the same type and capacity as the meters under test. If of different types they will have different characteristics, and hence give different registration for the same loads or variations from normal voltage, frequency or temperature. The standard should have several different capacities of series coils; their several capacities corresponding to the capacities of the service meters in use. Ten meters is about the number one man will test in one day.

### Free Lamp Renewals.

The writer is a firm believer in free renewals of burnt-out or blackened carbon filament lamps as a means of giving a good lighting service. It does away with the inferior lamps which will be handled by dealers, if customers have to buy them. In the plant, which the writer has charge of, the consumer buys his first set and is given free renewals in 10 and 16 candle-power carbon filament lamps, for all burnt-out or blackened

* Read before the Canadian Electrical Association's Quebec Convention.

** Supt. Canadian Electric and Water Power Co., Perth.

lamps; the company is the judge of when a lamp is sufficiently blackened to be renewed free. Mechanically broken lamps are not renewable free. The writer has gone ever farther along this line by maintaining Nernst lamps free. He has found that with good regulations and on a frequency of 133 cycles, the maintenance of Nernst lamps is lower than that of carbon filament lamps.

The use of tungsten lamps has been found very satisfactory, especially in the larger sizes for commercial lighting. Until the tungsten lamp is made more rugged than it is at present it is not very satisfactory for residential lighting.

The writer will make no attempt to go into the matter of rates, but simply calls attention to the fact that in making the rate to the consumer, in order to attract the desirable business, the cost of supplyinging that service should be borne in mind and the long-hour user given a rate which will not be prohibitive. We all realize that a perfect load factor is our ideal, and the better our load factor can be made, the more closely shall we approach success.

The day has arrived when the small station manager has awakened to the fact that business will not come to the office of its own accord, and simply requires to be taken care of. He must get out and hustle to sell his product as any other product is marketed. The writer's experience is that the best results in securing new business are obtained by personal solicitation. The merchant in a well lighted store with tungsten or Nernst lamps is proud of it, and explains to other merchants his reasons for lighting so brilliantly and the benefits he has derived from it, often making the statement that he has the best lighted store in town. This is the kind of rivalry to encourage. Well lighted stores becomes contagious. Jones & Co. will not be outdone by their competitors, and thus business comes rolling along without much trouble, when once the campaign is properly started.

### Electrical Displays.

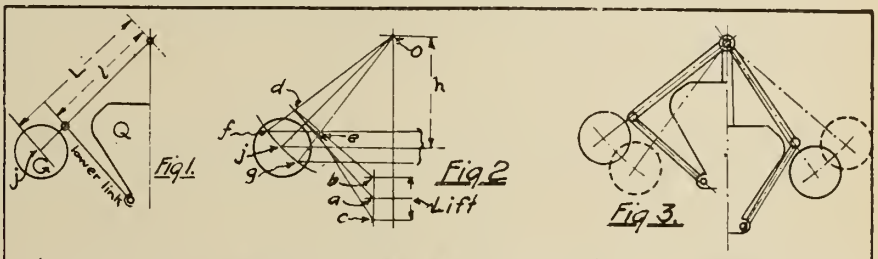
The writer has found that is is a good scheme to take advantage of any pure food shows and made-in-Canada fairs, etc., which may be held in town, to secure space for an exhibit of electrical heating and cooking utensils. The managers of such entertainments are usually very glad to have an exhibit, as it adds to the attractions, and they will give space free, or for a little electrical decoration. In this way it is possible to get in touch with prospective customers, which could not readily be reached otherwise.

The writed has recently introduced an electric vacuum cleaner outfit, which has proven very satisfactory. While it does not consume much current, it is of great convenience to consumers of electric current and tends to poularize the use of electricity. A charge per hour is made for the use of the machine and man to operate. It pays very well and keeps out the city vacuum cleaning machines with their high prices. Accounts for vacuum cleaning are rendered with light accounts without any additional cost. Current used to operate the machine is paid for at the same rate as lighting. The writer believes in selling "juice" and it does not make any difference whether a consumer uses it to clean house, wash or iron his clothes, cook his food, drive his machinery or light his house, as long as it is sold at a fair rate, and the more that it is used in the daytime, the better he likes it.

In conclusion, the writer wishes to mention a very effectual "ground," which he uses. It consists of an ordinary half-inch brass main cock, tapped into a water main. A No. 4 B. and S. wire is brought down the side of the pole from the lighting arrester or transformer and protected by a piece of iron pipe for about five or six feet above ground. The wire is soldered into the tail piece of the main cock and makes a perfect "ground." Ground wires should not be installed unless they can be connected to a permanent and effectual ground. A ground wire connected to a poor ground, not only fails, when it becomes charged to give the protection for which it is supposed to be installed, but becomes a positive source of danger to the passer-by. The writer can see no reason why an arrangement cannot be made with an water company for the use of such connections.

---

### TABLE FOR THE DESIGN OF GOVERNORS.




1st Assume lengths of arms L & l and lower link supporting center weights, also diam. and weight of one ball and the "lift" or vertical movement of center wt. on spindle.

2nd Lay out carefully to scale a diagram of the governor in central position as in Fig 1.

3rd Lay off vertically from point "a" (Fig 2) the points "b" & "c" which represent lift of Governor.

4th From points "b" & "c" with radius equal to lower link, locate "d" & "e."

5th From point "o" draw lines through "d" & "e" thus locating "f" & "g."

6th Draw horizontal lines through "f", "g" & "j". The vertical distance from "o" to line "j", gives "h" (see formula) for central position of governor and where the engine is supposed to run at correct speed.

7th Assume revolutions of governor, (=N) then figure out value of "Q" from formula. Q = ½ center weight in lbs. When engine slows down it allows the balls to drop to position "g" and the speed of the gov. at this point may be found by taking vertical distance from point "o" to horiz. line "g" as new value for "h." Using point "f" in same way gives speed of gov. when up.

8th Having found maximum revs. of gov. (when ball is at "f") and the minimum revs. (when ball is at "g"), find their difference and divide this by the normal revs. of gov (i.e. at j). The result is percentage of variation.

9th Determine if center weight can be placed in the available space between the arms and links by drawing the gov. in extreme up position on one side of a vertical center line, & in the extreme down position on other side. (See Fig 3)

Assuming L, l, Q & q. Find revs at ¢ position "j" (Formula 2) Assume percent. of variation of gov. speed, thus find new values of "h" (Fm'la 1) locating "f" & "g" Laying off from "d" & "e" gives "b" & "c" = lift for assumed percent. of variation.

$$h = \frac{35190}{n^2}\left(1 + \frac{2l}{L} \times \frac{Q}{G}\right) \quad \text{Formula 1}$$

$$n = \sqrt{\frac{35190}{h}\left(1 + \frac{2l}{L}\frac{Q}{G}\right)} \quad \text{Formula 2}$$

$$\text{percent variation} = \frac{\text{max. revs} - \text{min. revs}}{\text{normal revs.}}$$

L is in inches, h is in inches.
l " " "
G = wt of ONE ball lbs
Q = ½ wt. of center wt in lbs
n = revs. of gov. per minute

## SASKATCHEWAN'S LICENSE LAW.

Under the provisions of the Steam Boilers Act, it is illegal for any person who does not hold a certificate of qualification as an engineer to operate or be in charge of a steam boiler. Anyone acting in contravention to this Act are liable to a fine of not less than $5.00 and not more than $10.00.

### Provisional Certificates.

Any person who holds a certificate of qualification as an engineer from any incorporated body authorized to grant such certificates of qualification for operating steam boilers and engines or from the Dominion or any provincial Government or from any competent authority in any other portion of the British Empire or the United States shall be entitled upon making application to the commissioner accompanied by such evidence of his qualification as may be required by the commissioner and upon payment of a fee of $3 to obtain a certificate of qualification as an engineer in the class determined by the commissioner and to be registered under the provisions of this Act.

Any person who produces a certificate of uniform good conduct and sobriety from the owner or owners by whom he has been employed or from some other reliable person and shows to the satisfaction of the commissioner that he has had at least one year's or three threshing season's experience in the operation of a steam boiler or boilers, or at least three years' appreticeship in an establishment for the manufacture of steam engiuers or boilers or receives a certificate of an inspector certifying that he has been examined in the theory and practice of operating a steam boiler and found duly qualified may upon payment of a fee of $3 be granted a provisional certificate of qualification valid for a period of one year from the date thereof.

The commissioner may upon the recommendation of an inspector grant a provisional certificate valid for a period of one year from its date to any person who has submitted to an examination in accordance with the provision for certificates but has failed to receive from such inspector a recommendation for a final certificate of qualification.

Any holder of a provisional certificate of qualification may secure another certificate of the same class upon payment of a fee of $3 and upon the presentation of a recommendation satisfactory to the commissioner from an owner by whom he has been employed while holding such certificate, and if he is unable to secure such recommendation the inspector may make an investigation and upon his recommendation another provisional certificate may be granted.

Any holder of a provisional certificate of qualification issued under this Act may operate a boiler of 35 horse power and no more.

Before issuing a recommendation for the registration of and issue of a final certificate the inspector shall thoroughly examine the candidate as to his knowledge of the construction, care and operation of stationary steam boilers and engines and shall satisfy himself of his competency.

### Examinations.

The examination of the holders of the provisional certificates of qualification or of any person desiring to qualify as hereinafter provided and the issue of certificates to such candidates as may pass such examination shall be conducted in accordance with such regulations as may from time to time be prescribed by the commissioner and a fee of $3 shall be paid for every examination.

Final certificates issued under the provisions of this Act shall be divided into three classes, namely, into first, second and third.

Any person who holds or has held a provisional certificate or who can prove to the satisfaction of the commissioner that he has had extensive experience as an operator of a steam boiler may be allowed to write for a third class certificate.

Any person who can prove to the satisfaction of the commissioner that he has had at least twelve months' experience as chief engineer of a stationary boiler of not less than thirty-five horse power or as assistant engineer of a boiler of higher capacity than fifty horse power may be allowed to write for a second class certificate.

Any person who can prove to the satisfaction of the commissioner that he has served for twelve months as chief engineer of a boiler of not less than one hundred horse power or as assistant engineer of a boiler of a higher capacity than three hundred horse power may be allowed to write for a first class certificate.

No person shall write for a first or second class certificate unless he is of the full age of twenty-one years nor for a third class certificate unless he is of the full age of eighteen years.

Any person who fails at an examination for a final certificate shall before presenting himself for re-examination serve three months or one threshing season as chief or assistant engineer according to the requirements of this section and shall produce a statement from the owner by whom he was employed during that time showing that his services were satisfactory.

### Certificates.

A third class certificate shall be issued to every candidate for such certificate who receives forty per cent. of the marks obtainable on the paper written on by him and he shall while holding such certificate be allowed to have sole charge of any boiler of not more than fifty horse power or may act as assistant in the operation of a boiler of not more than two hundred horse power, provided that the holder of a first or second class certificate is in actual charge of such boiler.

A second class certificate shall be issued to every candidate for such certificate who receives fifty per cent. of the marks obtainable on the paper written on by him and he shall while holding such certificate be allowed to have sole charge of any boiler of not more than three hundred horse power or may act as assistant in the operation of a boiler of a higher capacity provided that the holder of a first class certificate is in actual charge of such boiler.

A first class certificate shall be issued to every candidate for such certificate who receives sixty per cent. of the marks obtainable on the paper written on by him and he shall while holding such certificate be allowed to have charge of boilers of any capacity.

If a candidate for a second class certificate receives less than fifty per cent. and more than thirty-five per cent. of the number of marks obtainable he may be granted a third class engineer's certificate if not already in possession of one.

If for any reason a candidate for final engineer's certificate is unable to write legibly the inspector may employ an amanuensis whose services shall be paid for by the candidate.

For any candidate for an engineer's certificate who fails to understand the English language the inspector may employ an interpreter whose services shall be paid for by the candidate.

Any candidate who considers he has been unfairly dealt with by any inspector may appeal in writing to the commissioner setting forth his grievance; and the commissioner shall at once cause such charge to be investigated and shall give a decision in the matter which shall be final.

Every person holding a certificate under this Act shall expose it in some conspicuous place in the engine or boiler room in which he is employed or cause it to be attached to the engine or boiler of which he is in charge; and in default shall be liable on summary conviction to a penalty of not less than $5 and not more than $20.

If such person be employed in charge of a portable engine and boiler he shall

produce his certificate for inspection on being required so to do by an inspector.

Any person other than those mentioned, who may desire to qualfy for registration and to obtain a certificate entitling him to operate steam boilers and engines connected therewith in the province shall serve twelve months or three threshing seasons as assistant to the holder of a certificate issued in accordance with the provisions of this Act and at the expiration of such term shall pass an examination as heretofore provided in this Act.

Before being entitled to such examination the said assistant shall file with the inspector satisfactory evidence as to the length and nature of such service.

When an inspector issues a recommendation for a final certificate under this Act he may grant an interim certificate to the candidate for a period of thirty days pending receipt of certificate from the department.

In case any owner of a steam boiler shows to the satisfaction of an inspector that he is unable by some unforeseen occurrence to immediately secure the services of a duly qualified person the inspector may grant a permit to any person who produces satisfactory evidence of good conduct and sobriety and knowledge of operating steam boilers to operate such boiler for a period of thirty days from the date of such permit and in such case no penalty shall be incurred by reason of the holder of such permit operating such steam boiler during the period covered thereby. A fee of $3 shall be paid to the inspector for every such permit issued by him.

# Power Plant of Shultz Bros. Co., Ltd., Brantford

### Power Equipment of Their Two Factories — Rope Drive in Their Wood Working Plant---Power Features of the Sand Lime Brick Works.

By JOHN THURLOW

The steam plant of Shultz Bros. consists of a 16 in. x 38 in. simple Wheelock engine, running 93 R.P.M., with a 13 ft. flywheel, 18 in. on the face and 9 in. deep on the rim, and weighs thirteen tons. The illustration shows this plant with an endless rope drive using 850 ft. of ½-in. Manilla 8-strand rope. It runs smoothly and gives no trouble.

The engine room is well equipped and situated so that no one can enter it except from the boiler room. The walls are kalsomined, the ceiling laid with matched ash, oiled, a railing surrounds the engine, while galvanized iron is laid under and around the engine to catch the oil drips.

The equipment includes a desk for writing and making out engine records, etc., a cupboard for keeping packing, tools and other supplies and a clock arranged so the fireman can see the time through the glass door between boiler and engine room.

The boiler room has an 18 ft. x 72 in. return tubular boiler, with 78 flues of 4 in. diam., a man-hole on top, a hand-hole at each end at the bottom, and lap-weld joints. The grate bars are 5 ft. long, made to burn shavings. The fire grate is 5½ ft. wide.

The boiler is fitted with a 4 in. weight and lever safety valve, the ordinary water column (no high or low water alarms) a 2 in. blowoff, of the goose neck shape, which works very satisfactory. A 3¼in. x 4½in. x 6 in. duplex steam pump made by the Canada Foundry Co., Toronto, supplies the feed-water to boiler, with a city pressure connection to discharge pipe for filling boiler when washing out, etc.

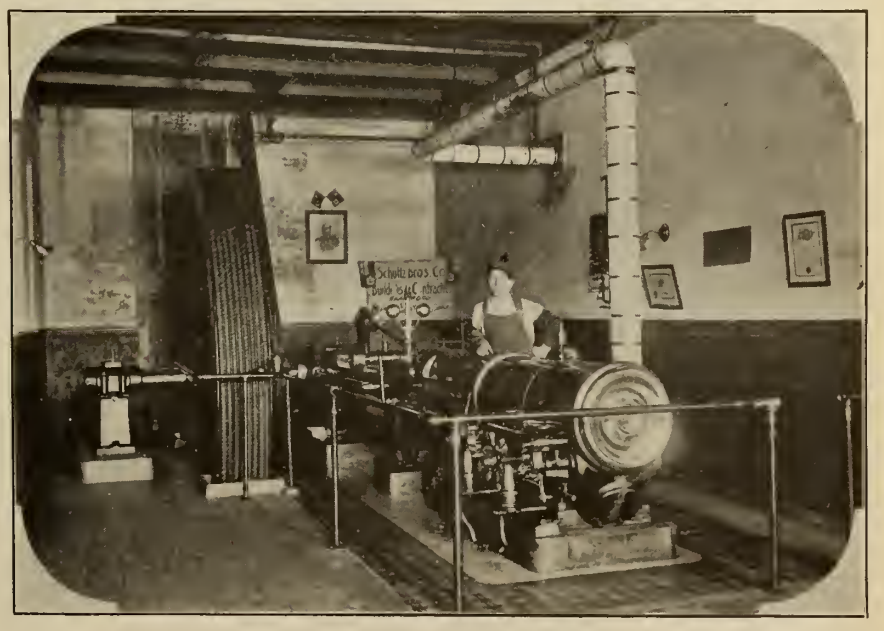
A single acting belt driven pump handles the condensation from the kilns and different heating systems (which is returned to one point) to the second chamber of a "Moffat feed-water heater, purifier and oil extractor." A third or more of our feed-water comes from this source. A 4½ in. steam main carries the steam from boiler to engine, while a 6½ in. carries exhaust from engine to the heater. As the engine room floor is 3 ft. higher than boiler room floor and the foundation another foot, there is no danger of water backing up into cylinder. A 2 in. live steam pipe crosses the boiler and engine room, and supplies a small 15 h.p. vertical engine on the second floor, belted to a hot blast fan for heating purposes, also to a couple of small coils, and some glue pots, and a glue box.

After the exhaust steam passes through the oil extractor of the heater, it heats the feed-water from 210 deg. to 220 deg. F., also cause the lime and much other scale-forming substance to deposit on the excelsior in top and centre chambers, thus purifying the water and preventing a large quantity of scale-forming substance entering the boiler.

The excelsior is renewed in the heater every four weeks, and in top chamber the excelsior is almost solid about half-way down with lime, etc.

The steam then passes out a 7 in. main which branches in two directions, one leading overhead in front of boiler to lumber dry kiln, while the other feeds the coil where the engine and hot blast fan is located for heating the main factory.

The exhaust after passing through the blast coil, is separated from the condensation and conducted up stairs to heat the paint shop, while the condensation goes to boiler room. The exhaust, after it passes from the big kiln No. 1 is also separated and conducted up stairs to a small room with 500 lineal ft. of 1 in. pipe to heat doors before the mortice joints are glued and also into another small kiln where a stock of dried hard-wood lumber is kept, there being just sufficient heat to keep it warm and thus



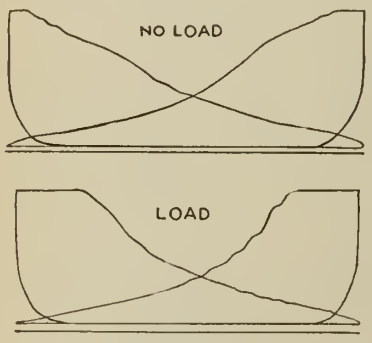
Engine Room, Schultz Bros., Brantford.

prevent it from absorbing dampness, which it would otherwise do since it is on the ground floor.

An 84 ft. chimney supplies natural draft for the furnace. The boiler steams very easily, using refuse for fuel. The engine heater and boiler was made by the Goldie & McCulloch Co., Galt.

### Sand Lime Brick Plant.

The steam plant in connection with this brick plant consists of one 14 in. x 34 in. simple Wheelock running at 84 R.P.M., has a 11 ft. flywheel, 18 in. face, and made by Goldie & McCulloch. A belt drive is used in the brick plant. The boiler is 18 ft. x 72 in. return tubular, with 74 4 in. tubes, with man-hole on top and at bottom in front end. The boiler is 5/8 in. plate, with butt joints and tested to 200 lbs. It was built by John Inglis, Toronto. It is fitted with




Cards of Shultz Bros.' Engine.

a 4 in. spring loaded safety valve set to 130 lbs.

A 6 in. main with an angle valve on it about 2 ft. from boiler shuts all steam connections, while branches from the other side connect with the different departments requiring live steam.

A 4 in. main feeds the engine, a 3½ in. feeds the two cylinders, where brick are baked and lime hydrated, a 2½ in. feeds boiler feed pump, whistle, the steam sand dryer, and a line to press, as steam issued to keep warm the liners and plates where the brick are made, to prevent the brick sticking to them.

### Steam Dryers.

The steam dryer revolves 30 R.P.M. and has ground steam joints at each end where steam enters and leaves. The condensation from drier goes into a tank from which a No. 3 Penberthy ejector discharges it into an underground pipe which carries all such drips and waste to a well, as the lime in the condensation makes it unfit for boiler feeding purposes.

Twenty iron cars, each holding 1,000 brick, are run into one cylinder, while cars with shelves holding iron trays with lime and water to hydrate for next day's run, is put in a second cylinder.

These cylinders are 62 ft. long by 6 ft. in diameter, made of ¾ in. plate, with butt joints, and are fed by a 2½ in. steam pipe branched from a 3½ in. main direct from boiler, and tested to 175 lbs.

A small pipe from each cylinder connects into one and is then connected to a recording gauge in the boiler room to keep a record of the pressure at all times, while the pressure is on them, as it is important to keep pressure uniform all the time. Each cylinder has a 2½ pipe on top to allow the steam to escape to the atmosphere in the morning when the ten hours' steaming is completed. On the bottom side of the low end a 2 in. pipe from each connect to a No. 4 Anderson steam trap to allow the condensation to escape, and the condensation goes into the waste well, because of the lime in it. Each end of the cylinder has a massive cast iron door swung at the top, and made steamtight by 44 bolts each 1¾ in. in diameter, and a 1 in. square ring of asbestos packing set into the head of cylinder, and projecting out against face of door.

These doors are hoisted by a stationary windlass, and then fastened up with two 1½ in. eye bolts hung from a beam overhead. The boiler in brick plant has a grate surface 5 ft. x 5½ ft., and an iron smoke stack 64 ft. high, set on the front end of brick work and boiler. The ordinary water column fittings are used, also hand-regulated dampers.

The brick plant has a feed pump the same size and make as planing mill, also a Moffat feed-water heater, oil extractor and purifier.

## WATER SOFTENING.

At a meeting of the Sheffield Society of Engineers and Metallurgists held on April 5, Mr. J. J. Sassen, of London, lectured on "Water Softening and Purification." The lecturer stated that it was useless to suggest that the employment of water-softeners would result in the saving of fuel, or that benefits could be prophesied in terms of money saved. Their chief claim to attention lay in the rendering of impure water suitable for use under a variety of circumstances. For example, their use ensured perfectly neutral water for dyers, the softening and purification of water pumped from coal mines, and the prevention of undue amounts of boiler deposits in districts such as London, where the water supply was charged with lime. The importance of a standard measure of degrees of hardness was dealt with by the lecturer, who showed that the ratio of units in Germany, England, and France was respectively 1, 1.24, 1.79. The impurities were classified as gaseous carbonic acid and ammonia, chemical and mechanical solutions of such salts as soda, potash lime, and magnesia. The necessity of converting any sodium carbonate present to the more harmless sulphate was proved by the statement that 10 grains per gallon of the former would cause the boiler to prime.

Temporary hardness due to the presence of the carbonates of lime and magnesia could be overcome by boiling by means of exhaust steam. The causes of permanent hardness due to the presence of the sulphates and chlorides of lime and magnesia, needed chemical treatment for their removal. The lecturer recommended the use of sodium carbonate in order to obtain very soluble salts together with the deposit of the carbonates of lime and magnesia.

The lecturer also showed that under ordinary circumstances it was cheaper to remove oil from water by the use of sulphate of alumina and sodium carbonate with subsequent filtration than by employing an electric current. The paper was illustrated with slides showing up-to-date plants for water softening and purification, and as an example of their effectiveness a case was cited where pit water showing 30 degrees of hardness was charged into the boilers only 0.95 degree.

## FIGURING COST OF ELECTRICITY.

According to electric experts, 746 watts (746-1000 kilowatts) electric current are equal in power to one horse power for one hour. At this rate, one horse power for 365 days, 24 hours per day, will take 6,534,960 watts, or say 6,535 kilowatts. At $25 per horse power per year on the above basis, this would be at the rate of 383-1,000 of a cent per kilowatt.

F. Jno. Bell has resigned from the board of directors of the Canadian Crocker Wheeler Co. He has also resigned his position as secretary-treasurer of that company.

W. Reavell, managing director of the firm of Reavell & Co., Ipswich, England, was in Toronto recently, and expressed himself as well satisfied with the outlook so far as business in Canada is concerned. J. F. B. Vandeleur, Dineen Building, is the Toronto agent.

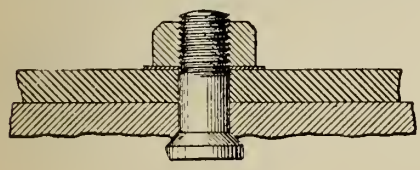
A. G. Fawcett-Valentine, C.E., (Eng.), has been appointed assistant superintendent of waterworks for the city of Peterborough, Ont.

W. H. Reynolds, who for the past five years has been connected with the Canadian General Electric as sales agent, has resigned to take up a like position with the Eugene F. Phillips Electrical Works, Montreal.

## PATCHING A BOILER.

By John W. E. Laker.

The following method of bolting a patch on a boiler perhaps shows some originality. It was required to patch the bottom of a combustion chamber of a very old boiler, badly pitted on the water side. Riveting was impossible for want of space. The patch was 5 ft. by 2 ft., fitted on the fire side, and the greatest difficulty to overcome was to make the bolts watertight, owing to the impossibility of driving them or getting a contact under the heads

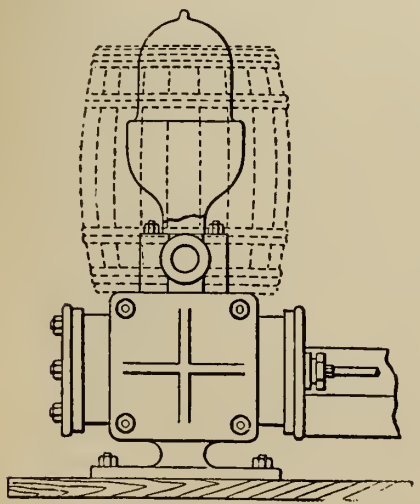


Patching a Boiler.

against the bad plates. Gaskets did not appeal to the repairer, and a metallic contact was aimed at. This was accomplished by making each bolt act as an ordinary mitre-seated valve. They were turned a hand-workable fit (all but the last ¼-in., which was tight) to reamered holes of steel, and case-hardened, fitted in from the water side, and hammered up with a spanner. The "seat" was sunk into the boiler-plates. There were altogether 128 bolts in the patch. The job, when finished, passed a Government surveyor's examination, and steamed from Honolulu to San Francisco without mishap.—Scientific American.

## REPAIRING A BROKEN PUMP WITH CONCRETE.

Concrete has been put to many novel uses. Few have been more novel, however, than that illustrated by the accompanying sketch, reprinted from the American Machinist. The story is that away back in the country a water power plant was being built to electrify



Repairing Broken Air Chambers of Pumps With Concrete.

a town down the valley. A steam pump was keeping the water out of the excavation and an unlucky swing of the derrick boom caused a loaded bucket to hit the air chamber of the pump and break it off, as shown. It was miles to a repair shop and a delay of several days seemed inevitable, but the contractor was ingenuous. The air chamber was put back in position, an empty barrel, minus both heads, was placed over it, with a notch cut out of one side to clear the discharge pipe, holes and openings were plugged and then the barrel was filled with concrete. After waiting over night and the next day for the mass to harden, the pump was started and it ran all right until the work was finished.

## CANADA'S WATER POWERS.

J. B. Challies, C.E. of the Department of the Interior, has made a computation of the water powers of Canada, and in this computation there is some information of very great industrial interest. Mr. Challies estimates the minimum flow development of all the water powers of Canada, at 25,682,907 horse-power, of which but 516,885 horse-power has as yet been developed. A calculation was made by R. E. Young, secretary of the Canadian Conservation Commissions, which showed that the maintenance of one horse-power per annum from steam power involves a consumption of 21.9 tons of coal. On this basis the available water powers of the Dominion represent a combined energy, which if it had to be maintained by steam force generated from coal, would involve a coal consumption of 562,455,633 tons per annum. The following summary of the available water powers of Canada is taken from Mr. Challies' report:—

| Location— | H.P. |
|---|---|
| Yukon | 470,000 |
| British Columbia | 2,065,500 |
| Alberta | 1,144,000 |
| Saskatchewan | 500,000 |
| Manitoba | 505,000 |
| North West Territories | 600,000 |
| Ontario | 3,129,168 |
| Quebec | 17,075,939 |
| New Brunswick | 150,000 |
| Nova Scotia | 54,300 |
| Total | 25,682,907 |

Out of over 25,000,000 horse-power available, little more than half a million has been developed, of which over 20,000 is in Manitoba, 73,100 in British Columbia, 1,300 in Alberta, 331,157 in Ontario, 50,000 in Quebec and 13,000 in Nova Scotia.

## OPPORTUNITIES IN CANADA.

We profoundly hope that the electrical manufacturers of the United Kingdom will not longer fling away their chances of doing business in Canada. It is passing strange that a thirsty soul should stand sipping scantily, when an overflowing bowl invites the first comer to drink deeply. — London Electrical Review.

## SETTING A MARKET VALUE IN A WATER-POWER PLANT.

"The value of such a plant," so says Mr. Charles T. Main, mill engineer, of Boston, "varies extremely with different conditions which govern the first cost, and with the character of the work done. The effect of the head, length of dam, length of canal, distance from canal to river, etc., increase or decrease the cost of construction. Very much better work is done in some places than in others, which increases the value and decreases the depreciation, so that no general rule can be given to cover all cases. The plant must be considered not alone, but in connection with the privilege, each being dependent upon the other, and each affecting the value of the other, as described in the earlier parts of this paper.

"For the water-wheels themselves, the average life of the wheel is probably about twenty-five years, while the casing might be allowed to outlive two wheels. Iron or steel penstocks, if taken care of, should last probably 100 years, but wooden feeders underground will not last fifty years. Wooden flumes, gates and tracks which are exposed to the weather will last about twenty years. Some wooden dams have lasted a great many years, but they are apt to get washed away in freshets. Stone dams, if properly designed and well built, will last for hundreds of years.

"The market value of the wheels would depend somewhat upon their efficiency, independent of their physical conditions; for it might pay to replace them, if water is expensive, by wheels of higher efficiency. The vertical wheels with bevel gears will not produce as much net horse power per cubic foot of water as the horizontal wheels; and with the horizontal wheels the extra expense and danger of breakage of gears is avoided."

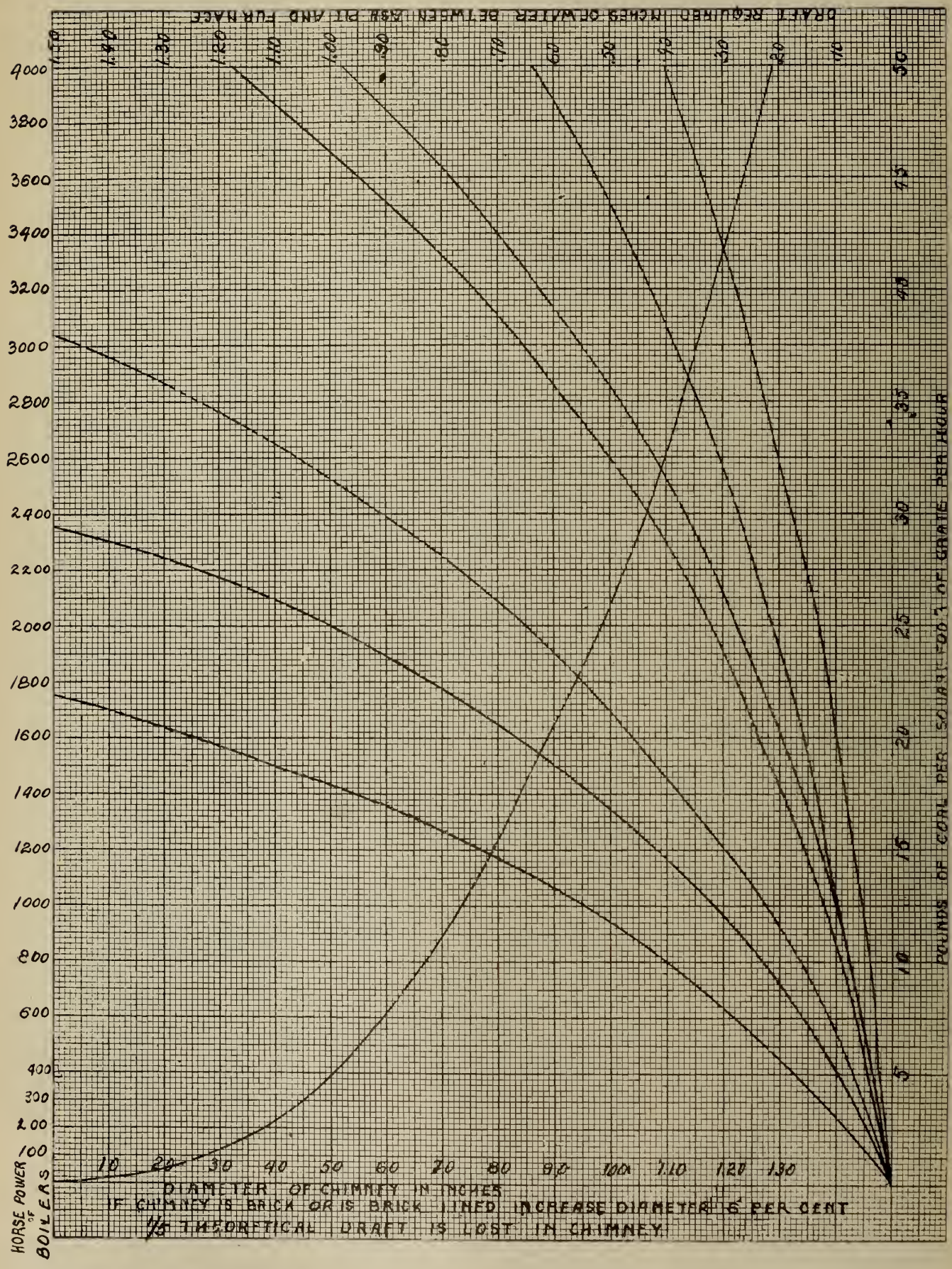
## IT LOOKS GOOD.

Brantford, Ont.

Editor "The Power House,"

Your June issue to hand and it "looks good to me," as the lads say. My article looks good also and must thank you for the splendid way in which you have treated me in this respect.

R. MANLY ORR.


HORSE POWER OF BOILERS
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
300
200
100
10 20 30 40 50 60 70 80 90 100 110 120 130
DIAMETER OF CHIMNEY IN INCHES
IF CHIMNEY IS BRICK OR IS BRICK LINED INCREASE DIAMETER 6 PER CENT
1/8 THEORETICAL DRAFT IS LOST IN CHIMNEY
POUNDS OF COAL PER SQUARE FOOT OF GRATE PER HOUR
5
10
15
20
25
30
35
40
45
50
DRAFT REQUIRED MEANS OF WATER BETWEEN ASH PIT AND FURNACE
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10

# INDUCED DRAFT

AND THE

# GRAPHIC DESIGN OF CHIMNEYS

By K. CAMPBELL

Chimneys are required for two purposes, to carry obnoxious gases and to produce draft to facilitate combustion. The first requires size and the second height.

Height and area are the only elements necessary to consider in an ordinary chimney. The intensity of draft depends on the difference of weight of the inside and outside columns of air, which vary nearly as the product of the height into the difference of temperature. This is usually stated in inches of water.

A round chimney is better than square, and a straight flue better than a tapering. The effective area of a chimney for a given power, varies as the square root of the height. The actual area, in practice, should be greater, because of retardation of velocity due to friction against the walls.

### Graphic Design.

Referring to the diagram the lines represent the grades of coal. Thus, the first line at the bottom is "run of mine bituminous," second "bituminous slack," third "run of mine semi-bituminous," fourth "chain grate—bituminous s'ack," fifth "anthracite pea," sixth "No 1 anthracite buckwheat," and seventh (top line) "No. 3 anthracite buckwheat." These lines may be written on the plate shown on the opposite page to facilitate using the diagram. The curve crossing these is the "Curve of Chimney Diameters."

The following data is required in the graphic design:

Temp of Stack.

750 ... ... ... ... ... K=.0084
700 ... ... ... ... ... K=.0081
650 ... ... ... ... ... K=.0078
600 ... ... ... ... ... K=.0075
550 ... ... ... ... ... K=.0071
500 ... ... ... ... ... K=.0067
450 ... ... ... ... ... K=.0063
400 ... ... ... ... ... K=.0058
350 ... ... ... ... ... K=.0053

D=KH.

D=draft in inches of water.

K=constant.

H=height of chimney in feet.

### Resistances.

Loss of pressure through boiler about .4 ins. for 50 per cent. overload.

Loss of pressure through 100 feet of flue=.1-in.

Loss of pressure through 100 feet square flue=.2-in.

Loss of pressure through short right-angle bend, about .05-in.

Loss of pressure through easy right-angle bends about .03-in. For stokers deduct 10 per cent.

### Problem.

Assume plant of 2,000 horse-power, water tube boilers, ratio grate to heating surface=1 to 50, coal evaporates 9.5 lbs. water from and at 212 deg. F., run of mine bituminous coal, mechanical stokers, square flue 80 feet long, brick lined. brick-lined stack and 4 sharp right-angle bends. Find dimensions of chimney allowing 50 per cent. overload, flue gas temperature at 50 per cent. overload=600 deg. F.

$$R = \text{ratio of } \frac{\text{grate}}{\text{heating}} \text{ surfaces.}$$

S=sq. ft. of heating surface to boiler horse-power=10

E=9½ lbs.

$$\frac{34R}{SE} = \frac{3\frac{1}{2}R}{E} = \frac{3\frac{1}{2}\times 50}{9\frac{1}{2}} = 18.4 \text{ lbs. coal per}$$

sq. ft. per hour approximately.

At 50 per cent. overload coal consumption the coal used would be 60 per cent. greater than this, therefore coal per sq. ft. hr=18.4×1.6=29.4 lbs.

Referring to the bottom of the cut, find 29.4 and follow up to first line, "run of mine bituminous," then follow to the right and the draft is seen to be =.16 of water.

Draft required=.16—10 per cent for mechanical stokers=.15 in. water for bed of coal.

$$\text{Draft required for flue} = \frac{2}{10} \times \frac{80}{100} = .16$$

ins. for flue, as it is 80 feet long and .2 ins. per 100 feet, as seen from the table of resistances.

Draft required for the boiler (between the tubes) is .4 ins. for 50 per cent overload.

Four short right-angle bends require .05×4=.20-ins. draft.

Total draft=.15+.16+.40+.20=.91 ins. total resistance.

Draft=KH where H=height of chimney.

For temperature 600 deg., K=.0075.

D=KH.

$$H = \frac{.91}{.0075}$$

Referring to left side of table, 1-5 draft is lost in chimney.

Therefore

$$H = \frac{.91}{.0075 \times .8} = 151.6 \text{ ft. Ans.}$$

To find diameter take curve at right angles. Follow down from 2,000 horse-power to line at right-angles and then to left side of chart. For 2,000 horse-power, diameter=98 ins., but as 6 per cent (see left side of chart) is lost in a brick-lined chimney. the diameter=

$$\frac{98}{.94} = 104.2 \text{ ins. Ans.}$$

### AIRSHIPS MADE IN CANADA.

The Canadian Aerodrome Co., with headquarters at Baddeck, C.B., are constructing two aerodromes, and are giving employment to a large number of men. The dromes are constructed largely of metal, and they are modelled after the "Silver Dart," with which several successful experiments were made during the past winter.

# PRACTICAL ARTICLES BY OUR READERS

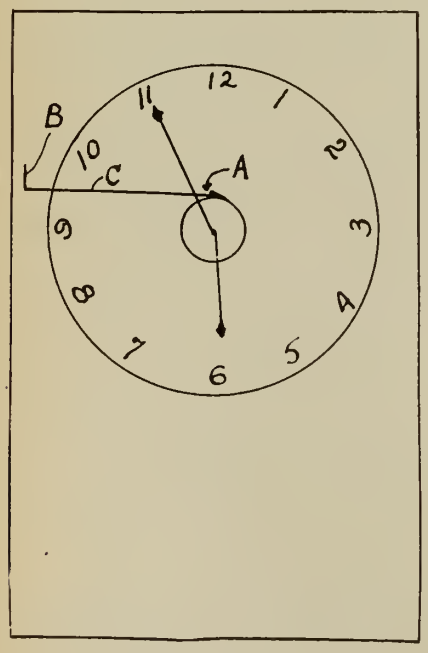
**Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.**

## AN ELECTRIC ALARM.

By L. B., Hamilton.

The accompanying sketch shows a simple arrangement for an alarm clock. The writer has had a similar arrangement in use for about 15 years, and I thought it might be of some service to some one else.

It does not cost very much to put the arrangement on any clock. It consists of a sheet brass disc, No. 24, B. & S. gauge, 2 in. diameter, and a sheet fibre disc 2 1-16 in. diameter, 1-16 in. thick. These discs are put together by a brass bush or hub, which is drilled and reamed to fit the hollow shaft of the clock, by which the hour hand is driven, and




An Electric Alarm.

these discs are put on behind the hour hand.

Then a piece of spring sheet brass, No. 26, B. & S. gauge, ⅜ in. wide, long enough to reach from the centre of the clock face to clock frame, as seen at C, with one end bent at right angles so that is can be screwed to the frame. The straight end is placed on the fibre disc (see A).

A nick is filed in the edge of the fibre disc, ⅛ in. long, about 1-16 in. below the edge of the brass disc, as seen at A. Then connect in a circuit one dry cell, an electric benn, and a small switch. Put these in any convenient place. Then attach one wire at B and the other to any part of the clock movement.

Turn the disc so that the spring C will drop into the nick A at the time that the alarm is desired to go off. Close the switch when you retire and you will be forced to get out of bed when the bell rings to open the switch.

---

## HOT BEARINGS.

By H. H. Ward.

A hot bearing is ever a source of annoyance to the modern engineer, yet bearings do not become overheated through "pure stubborness"—there is always "a reason."

The fault, great or small is one which is always irritating to an engineer who likes to have his engine running smoothly, and economically. By economy I refer to the lubrication of the different parts of his engine. Sandpaper will not become smooth by being saturated in oil. This is true also in reference to the motion-work of any piece of machinery, the indiscriminate oiling of which will not prevent the bearing from running hot, once there is lodged sand, or other hard substance on its face. Therefore great care should be taken to see that your oil is perfectly free from any substance that may cause the bearings to run hot.

Flake graphite mixed in small quantities with the contents of your oiler is a preventive if not a cure in dealing with hot bearings.

If a bearing becomes so heated that the babitt is being melted let it clean itself entirely out, then sprinkle thoroughly with sulphur. This has been found to be an excellent remedy for cooling hot bearings, and is well worth trying.

---

## LEATHER BELTING.

By K. Campbell.

In discussing a paper on the transmission of power by leather belting H. J. Hathaway of the Tabor Mfg. Co. gave some interesting data in relation to belt drive.

If a machine stands idle during working hours while the belt is being repaired or tightened it produces nothing during that time, and there is a distinct loss to the manufacturer. If a machine stands idle for one-half hour out of ten hours working time there is a lost of 5 per cent. in the output of that machine and if in a shop having 100 machines, 10 machines out of the 100 lose one-half hour each day on account of repairs to belts it amounts to a loss of 0.5 per cent. on the total output of the shop. This feature, however, is probably not so bad as the loss in output due to the machine belts being run so loose that they cannot begin to take the feeds, speeds, and depths of cut for which the machines are designed and that the tools will stand.

Almost every engineer, foreman or superintendent, in attempting to bring up the speeds of his machines to something like what he knows to be possible, has found that such attempts usually result in the belt's slipping or breaking, or the lacing giving out, and knows that where the care of belts is left to the man on the machine, only in a very few cases can the belts be dedepended upon to do the maximum amount of work. Belts of the best quality must be used at proper tension, and they must be kept in first-class condition, and inspected outside of working hours.

Very few machinists or even foremen know how to tighten or lace a belt properly, the amount to be taken out being usually guessed at, and a great deal of time is lost through the machine's standing idle while the cutting and trying is going on. A good machinist has been seen to run a cone belt, which he has made too tight, on "cross cones," i.e., on steps not in line with each other, with the result that it twisted itself up like a corkscrew and was practically ruined.

Another cause of premature ruin of belts is improper lacing, the ends not being cut square and the lacing on one side stretching more than the other, causing the belt to run crooked.

Cemented splices, when properly made, give the best results. Machine lacing, using a spiral wire lacing, while not so good as a cemented splice, is very satisfactory, however, and more convenient, and takes less time for putting on and taking off belts for the purpose of testing and tightening on the belt bench. A belt joined by a cemented splice must be tested and spliced in position, which is not so convenient as on the belt bench, especially in the case of over-head belts. Even where cemented splices are used the belt bench is convenient for cutting new belts, or re-tightening to a length giving the proper tension, and for re-

pairs. Only one wire joint is used in any belt, splices being made if a section becomes damaged so that a new piece must be set in. The average belt if cared for under this system will last from six to eight years.

The tension on a new belt falls very rapidly, and present practice is to tighten it after 24 hours, then in 48 hours, then in one week, then in two weeks, and so on doubling the length of intervals until it gets to three months; from this point we must ascertain by trial for each belt how much greater the intervals may be. This of course depends upon the severity of service the belt is called upon to perform as well as the quality of the belt.

## CURING HOT BEARINGS.

By E. B. P.

The bearings on a belt-tightner pulley which carried the main driving belt 48 inch in width caused me some anxiety from heating for some few weeks after being installed. These bearings were of the self-oiling, self-aligning variety and had independent oil-cellars at each end of the bearings. The trouble seemed to be caused by the oil creeping on the shaft from one cellar to the other and then being thrown out upon the floor. Thus one end cellar would become dry, and heating would result. After taking these bearings down a couple of times, and scraping them the idea came to my mind to join the cellars.

Each oil-cellar had an $\frac{3}{8}$ in. plug in the bottom for draining it, and, by taking out these plugs and by using some nipples, ells, and a union the job was soon done and the trouble was over.

## EVERLASTING LUBRICATION.

By E. Crabtree.

The necessity of proper lubrication for high-speed machinery is acknowledged by all machine builders and users, and although various devices have been applied in the shape of automatic oilers, grease cups and ring oiling bearings, these have all got their drawbacks inas-much as should a careless apprentice fail to keep these devices filled with lubricating product, the machine is left to take care of itself and a lack of lubrication is not realized until bearings become heated or the machine refuses to run.

A very successful and most economic way of overcoming any defects such as the above has been in the bearings themselves being so constructed as to produce enough lubrication to last out the life of the bearing itself without even the application of oil or grease, or any attention whatever, especially in machines where bronze bearings are used.

The principle as applied is to first bore out the bearings the required size to suit mandrel, then take and drill several rows of holes from end to end of bearing, size of hole varying according to size of bearings, drill these holes with the second and following rows of holes directly under the spaces of the previous row of holes, thus the shaft or mandrel gets lubrication the entire length of bearing, (see Fig. 1). In a bearing, say 6 in. long, holes need to be about $\frac{3}{8}$ in.

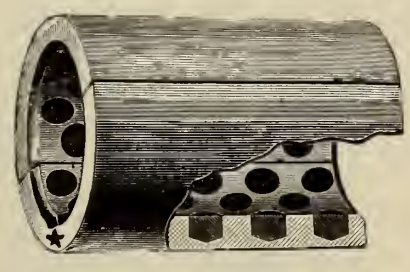


Fig. 1.—Lubricating a Bearing.

diam. and drilled as deep as possible without going right through casting, afterwards taking off the burrs round the holes and leaving a space about $\frac{3}{8}$ in. between each hole. Then fill each hole as tight as possible with a good quality of graphite. The bearing is then ready for use and will need no further attention. One supply of oil when machine is first started, is all that is required and will insure a cool, steady running machine.

Cast iron bearings are excellent. Without attention, bearings quickly heat and usually the spindle or shaft tightens as to be almost inseparable. The above method of placing holes in such bearings, fitted with graphite will be found to overcome this difficulty, and give

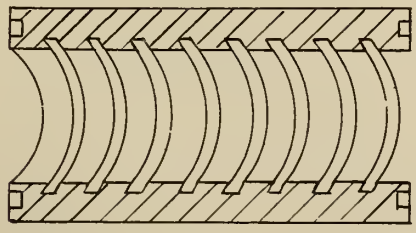


Fig. 2.—Section of Round Bushing With Square Thread Filled With Graphite.

every satisfaction. The use of graphite as a lubricant for bearings is of very great importance as applied to pulleys running either vertically or horizontal, and where it is difficult to get at them to apply oil or grease. The best method of fixing pulleys with graphite bearings is to procure a brass bushing, having hole bored to fit shaft. The inside may either have holes bored through as in bushings before mentioned, or two threads (square) may be put inside and the grooves and holes filled with graphite. Where two pulleys run together the bushing can be grooved at the ends and filled same as the holes (Fig. 2). The bushing is then forced into the pulley as tight as possible and pulley will need no lubrication as long as bushing lasts, besides being always clean and very economical.

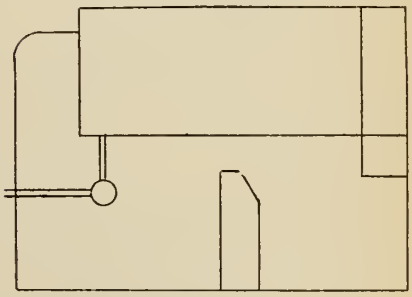
## SOME TROUBLES AND THEIR CURE

By M. C. Smith

The Power House has come to hand and is very complete. I notice that you accept practical devices from subscribers for publication. After relating a serious experience I witnessed recently, I will send a couple of useful devices for your inspection.

I had just taken charge of a steam plant and was about to wash out the boiler, when I found a badly pitted spot just inside the forward hand-hole, and upon entering the boiler, I found to my greatest surprise, that the entire bottom of the shell, up to the waterline, was pitted $\frac{1}{4}$'' deep from end to end, which resulted in the condemning of the boiler.

This boiler is only five years old, but



Showing Position of Ball.

should have been inspected. An engineer had charge of this plant the first two years, and, it is claimed, was never inside. It leads me to ask the question, "what prevents boiler explosions in this country?" This boiler is not safe for more than 50 lbs., while 105 had been carried regularly.

It is often noticed that the lubricator glass will become spotted and the oil will run up the side, instead of feeding properly. This can be cured by making a piece of wire needle-shaped, and fastening same to nut at the top of the glass mounting, allowing it to hang down within $\frac{3}{8}$'' of the feed nipple. The oil will then follow the needle.

Another very serious trouble results from blow pipes burning off. There is for this a genuine cure, which is cheap and easily made where there is access to a foundry.

First secure a cast iron ball or globe and tap it out at right angles, thus making it serve the same as an elbow. By blowing out a barrel of water each day no trouble will arise. A 12" or 14" globe works best of any, and I have found it better than a mud drum. This can be used either with a combustion space or an arch full length.

## CONSERVATION OF ENERGY.

By "Live Wire."

In the study of mechanics we are taught some very important rules, which it would be wise for us to keep constantly before us and to apply to our daily work every time the opportunity presents itself.

One of these rules is: "Energy like matter can never be destroyed." All we can do is to change it into another form. We may throw any substance into the fire, say, "that ends that," but such is not the case. The matter may be changed into some other form but not destroyed.

Some time ago a question was asked. (and it is an old question), what becomes of the energy stored in a fully wound clock spring placed in a strong acid and dissolved. Some have attempted to prove that the energy in such a case is entirely lost, but such is not the case. The following is presented as an explanation:

In winding up a spring work would disappear and an equivalent amount of heat be produced (by the friction of the molecules in the bending spring), which would be dissipated into the surrounding air. Then when the spring is allowed to unwind the reverse takes place. Thus if a wound up spring were destroyed in acid, its energy would not be lost. You might just as well maintain that, the spring would give off more heat if dissolved on a hilltop than in the valley below because its potential energy is greater on the hilltop.

It is an easy matter to figure out what becomes of the energy of an unharnessed waterfall. Every engineer should know that it takes 778 foot-pounds to produce one B. t. u. One heat unit is the heat necessary to raise the temperature of one pound of water one degree Fahrenheit. We will see what becomes of the energy of Niagara Falls.

The average flow of the Niagara River is 75,000,000 gals. per min. or 750,000,000 lbs. per min. The fall is 160 ft. In other words, neglecting the velocity of approach each pound of falling water would have 160 lbs. of kinetic energy at the end of the fall. This energy converted into heat would be sufficient to raise the temperature of each pound

$$\frac{160}{778} = .20F$$

$750{,}000{,}000 \times .20\ F = 150{,}000{,}000$ heat units produced.

Some of the energy is used in wearing away the rock and in air friction.

## A UNIQUE HEATING PLANT.

By W. E. D., Montreal.

Enclosed is a photograph which I thought might interest some of your readers. It represents six locomotives that were used to supply heat to the new shops of the Intercolonial Railway at Moncton, enabling the continuance of the concrete work inside the shops. It was popularly known as "Joe Graham's fleet."

Joe Graham's Fleet.

## THE INJECTOR.

By M. E. D.

Sometimes the injector refuses to work and engineers are at a loss to find the cause. By reference to the following list of causes, the operating engineer may be able to locate the trouble.

1. Leak in suction pipe.
2. Supply cut off by strainer getting clogged up.
3. A loose lining inside of hose.
4. A leak around stem of suction pipe valve.
5. Too low pressure for the lift.
6. Too high pressure on high lift.
7. Dirt or scale in jet or tubes.
8. Bad check valve not lifting enough or not at all.
9. Loose disc or water supply valve.
10. Connection to steam pipe used for other purposes.
11. Water supply too hot.
12. Jets become corroded with lime and cause trouble. In this case soak jet in a solution of one part muriatic acid to eight or ten parts of water until lime is removed.

## SOME GASOLINE ENGINE DON'TS.

By M. E. D.

The following are a few don'ts for those in charge of gasoline engines. By following them engineers will have very little trouble, if any, with their engines. Some of them will apply to those using gasoline for other purposes.

Don't think your engine needs no attention because it is a gasoline engine.

Don't lose your temper if it fails to go at the first turn of the crank.

Don't forget to see that the gasoline tank is free of all particles of dirt before filling it.

Don't use a poor oil because it is cheap.

Don't look for gasoline leaks with a match.

Don't run the engine if it pounds; stop and investigate.

Don't run the engine with played-out batteries.

Don't try to run without oil.

Don't cut the oil supply down too low.

Don't flood the engine with oil.

Don't try to start without first turning on the switch.

Don't forget about turning on the gasoline.

Don't start without first opening the water intake.

Don't advance the spark lever too fast; don't advance it too far.

Don't risk cutting the insulation of the wires by fastening them with tacks or staplers.

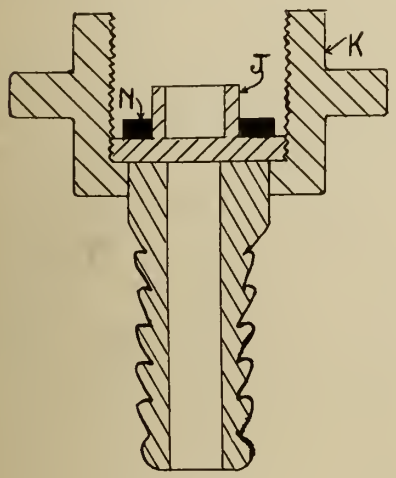
Don't run wires under the floor or in inaccessible places.

Don't attempt to clean the engine while it is running; the waste rag may become caught in the gears.

## AUTOMATIC VALVE FOR USE WITH PNEUMATIC TOOLS.

By S. B. Kennedy.

The accompanying sketch shows an automatic valve slightly different from a type I have seen in use. The ones I refer to, are minus the spring and sometimes give trouble by refusing to close after the hose nut is unscrewed. A glance at the sketch will show how it operates. When hose nut is screwed on to nipple (H) the spigot (J) inside of nut makes contact with carrier (C)

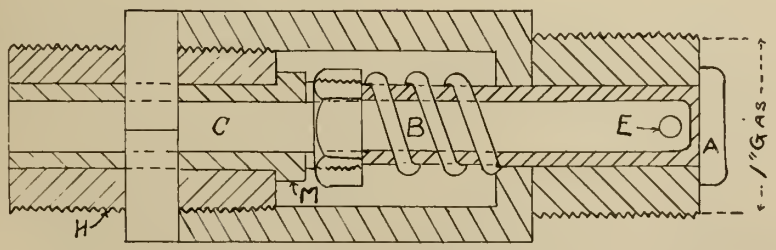



Hose Connection.

which lifts the valve (A) and allows the air to enter at (E). These valves are very handy where several branches are needed for you can have a stop-cock on the service pipe and as many branches as you wish working independent of the stop-cock.

(E)—3¼ in. holes through which air will pass when valve is raised by coupling an air hose.

(B)—Spring to ensure valve closing.




Automatic Valve for Air Hose.

(J)—Spigot (J) makes contact with carrier.

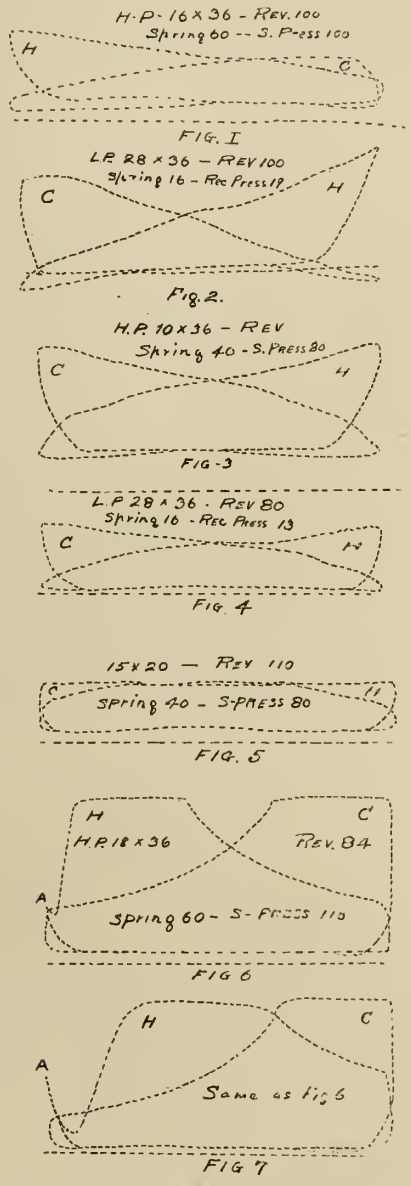
(C)—Raises valve when hose nut (K) is screwed on to nipple (H).

(N)—Leather washer.

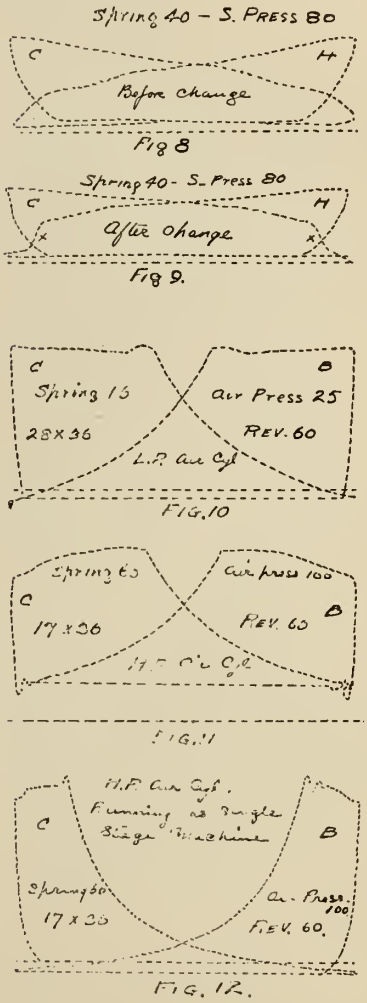
## PRACTICAL VALUE OF INDICATOR CARDS.

By J. A. Carruthers.

The accompanying indicator cards may serve to emphasize the practical value of indicator work to engineers, i.e., aside from its value as an index of the power, efficiency, etc., of engines in general.




Figs. 1 and 2 were taken from a cross-compound slide-valve engine, which at 100 R.P.M. was too big for its work; also, there was excessive outside lap on the valves of both cylinders, which required too great an angular advance of the eccentries. After reducing the lap (the amount being arrived at by the use of Zenner's valve-diagram), and also the engine speed by substituting a smaller




Practical Value of Indicator Cards Reduced to ¼ Size.

pulley on the counter shaft, the cards shown in Figs. 3 and 4 were secured. Although the load had been reduced somewhat between the taking of the two sets of cards, yet the engine showed up better after the change by reason of doing more work per stroke.

Fig. 5 indicates what may be expected in running an ordinary slide-valve engine on the throttle; as will be noticed there is little or no gain due to expansion.

Figs. 6 and 7 are taken from the high pressure cylinder of a cross-compound Corliss engine whose valve-cranks have a bad habit of working loose on the spindles. When I took the card shown in Fig. 6, the lost motion in the head-end valve-crank was very little from a mechanical standpoint, but its result can readily be seen in the late admission at A. As the engine could not be spared out of use at that particular time,

it had to run another couple of weeks before getting repaired; and Fig. 7 shows the rate of increase of the trouble. The late admission at A, the late cut off and high terminal pressure certainly indicate a slump in economy as well as a disturbing effect in rotation.

Figs. 8 and 9 are cards that appeal to engineers "from Missouri," and are taken from the same engine, a cross-compound slide-valve with no riding cut-off valve. A certain change was made in running conditions between the taking of the two cards, with the result of release shown at x, Fig. 9. Might say that I forwarded these cards to a prominent engineering journal several years ago, but never received the correct solution from any of the readers. Would like to hear from "The Power House" subscribers re the pair.

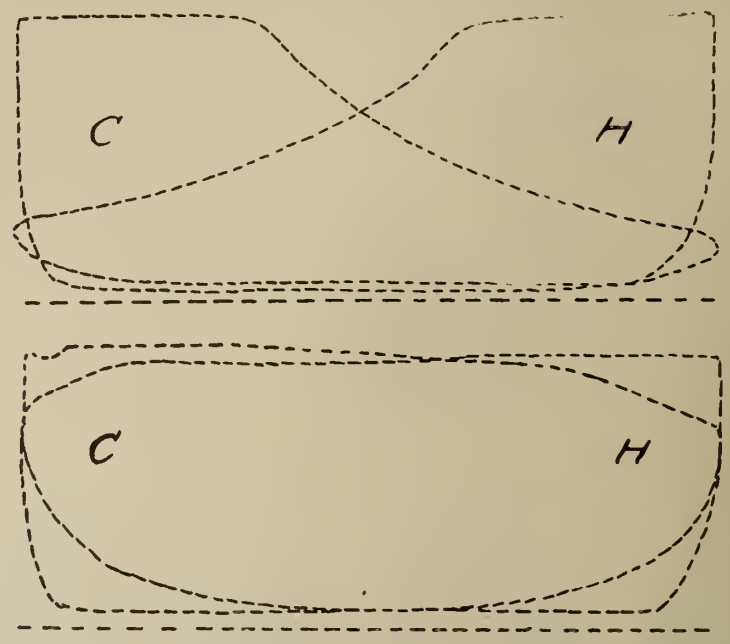
The cards shown in Figs. 10, 11 and 12 may interest those engineers having air-compressors in their charge. Figs. 10 and 11 are taken off a two-stage machine with mechanical inlet valves on the low side, which, as shown, give a prompt and free admission of air. The discharge valves of the first-stage and both inlet and discharge of the second stage are of the poppet type, and clearly show their effect on the different lines of the diagram. Fig. 12 indicates the great advantage of a multi-stage compressor over that of a single-stage, but of course in this case the difference in capacity, etc., is exaggerated owing to this cylinder not having been designed for single-stage operation. The card was taken during a temporary shutdown of the low-pressure side of the compressor owing to an accident, and represents the high-pressure cylinder taking its air at atmospheric pressure through the intercooler and withdrawn valves on the low side. As will be noticed the capacity of the machine is greatly diminished.

## HOW SHOULD THE VALVES BE SET?

By E. B. P.

The other day an engineer friend from a neighboring plant came into my engine-room and said his engine had developed quite a pound and asked me to loan him my indicator. Not being very busy at the time I went over to his plant with him and when we took a card we found it a case of unequal cut off and after making adjustment we took card No. 1. Needless to say that the pound disappeared.

This engine is carrying an extremely variable load as will be seen by card No. 2, which we took while the engine was carrying its valves wide open full stroke. The engine is a John Inglis & Sons, Corliss 24" x 42" and makes 74 rev. per min., boiler pressure 100 lbs. and scale of spring 60. We would like to know the I.H.P. developed and also if your readers have any suggestions to make in regard to the valve setting.

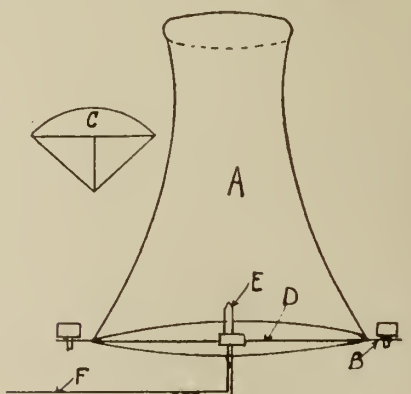



How Should the Valves be Set? Cards Full Size.

## SMOKE CONSUMER.

By R. Douglas.

This consumer is placed at the back of the grate, as close to the bridge wall as possible, and when connected up, acts as follows: The casting gets very hot and the steam turned on draws the air up at a good force, the two combining and forming water gas, which completely takes the smoke away. This is a decided advantage where draft is bad.




Smoke Combustion.

Referring to the drawing, A is a casting with two lugs at B for fastening to grate. C is a cap with three ridges and fits on top of A. D is a fillet across centre of casting, tapped to take a ¼ pipe E which has the nozzle reduced to ⅛. F is the ¼ pipe under grate, which runs through the front.

## ERROR OF WATER METERS.

In connection with the many tests made in various boiler plants with the object of determining the conditions of every day operation and how increased economy could be obtained, the Coal Department of the Arthur D. Little Laboratory, Boston, have had occasion to calibrate several water meters. In one instance a hot water meter read 55 per cent. too low, another read 30 per cent. low, when passing 136 cubic feet per hour, and 36 per cent low, when passing 102 cubic feet per hour. On account of the slip and leakage most of the meters read too low, but one case was found where a meter read 13.0 per cent. too high. Even with a calibrated meter the results are questionable on account of the varying error at different rates of flow and the non-uniformity of feeding the boiler.

---

It is understood that a majority both of the Canadian and American Commissioners of the International Waterways Commission will recommend that a dam be built on the Niagara River, opposite Buffalo and Fort Erie, for the purpose of raising the level of Lake Erie. In the autumn of every year there is a fall of about two feet in the level of the lake. This reduction of available navigation depth seriously affects the shipping interests; and with the increase in the size of vessels it is becoming a menace to navigation. The estimated cost of the dam is about $5,000,000.

# Correspondence and Discussion on Previous Articles

Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### OVERWORKED.

The article by an interested Listener on page 38, June number, is amusing and interesting. Some of your readers may imagine the word picture overdrawn of the Dutchman's method of curing the safety value's cough. An experience I had in a cheese factory in Peterboro county some years ago is quite as bad.

I was sent out there to make some alterations in the pipe work, etc., and when I arrived I found there was no regular fireman or engineer; the cheese maker received $2.50 a day, from 10 to 15 hours a day, and besides attending to the cheese making, receiving milk, attending to the machines, cleaning the factory, etc., he also attended (question here) to the boiler and engine. The fuel was four foot slabs and scrub timber and as it was an utter impossibility for the man to attend properly to half his duties, he left the firing of the boiler to chance loafers, or any farmers who happened to be around, and they sometimes did it "for fair."

This day when I arrived, I was guided to the boiler room by a hissing and clattering and when I entered, I had the same hair raising feeling the Dutchman's visitor had. The boiler was a good one, thank goodness, otherwise I would not be in the land of the living at the present day. As an engineer, my first glance when I entered the boiler room was at the water and steam gauges, the water was in sight, but that was all, the steam pressure was out of sight, at least part of it was. The gauge was made to register 150 lbs. and the index hand had made a complete circuit and was prevented from starting on a second trip around the gauge by the stop pin at the zero mark.

Understand, Mr. Editor, this is no fairy story, but the honest truth. A couple of volunteer slab throwers were busy hustling in more fuel. I yelled at them to drop it and make for safety I also moved out rather rapidly myself and told the cheese maker, man of all work to say his prayers and to work while he was saying them, and get the fire out of the furnace. I explained to him in as few words as possible, the danger we were all in, and then started for the high ground, where some of the amateur firemen already were, intending to watch the ascension of the cheese factory from a distance.

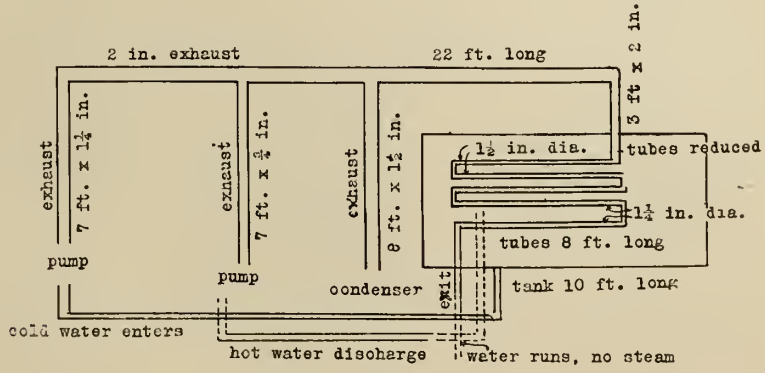
The cheese man had grit, or perhaps his life was such that he did not value it very much, for he pulled out the fire and then came and kept us company. Well I cannot say to what it was due, but the boiler did not blow up.

In the dim past, a safety valve used to adorn the boiler, but it had been removed for repairs and had never been replaced. In its place was a fine blank flange about 1¼ inches thick. I could fill a book about this one plant, but I think the foregoing is enough to show that it is not only the boiler sellers or engineers who are always to blame, but sometimes the employers who expect one man to do three men's work for one man's pay.

JAMES E. NOBLE.

### IS THERE ANY BACK PRESSURE?

I would appreciate receiving replies to this question. The engine and piping arrangement is illustrated in the accompanying sketch. The condenser jumps and nearly stops occasionally, and I would like to receive an answer through The Power House.



Is There Any Back Pressure?

"Anxious One."

### BOILER EXPLOSION.

I noticed in the May number, the report of the explosion of a steam boiler near Toronto. Recently I visited a saw mill in a neighboring town to see an old friend. I stopped at the boiler room for a moment and noticed that the gage registered 100 lbs. pressure. I asked the engineer what pressure he carried. In answer he replied, "Oh, about a hundred." I glanced at the gage again and it registered 115. He slammed the dampers shut, and made the remark that he never allowed it to blow off as it leaked afterwards.

That is just how most boiler accidents happen. I know of boilers that have blown up in this manner, in this county with loss of life and property. I would like to see all steam boilers inspected by a government inspector, and all engineers examined and graded, then if there are any incompentent men among the engineers they will be given their proper place. I have a certificate but am willing to lose it if I cannot do the work, an engineer is called upon to do.

Reader of The Power House.

---

The city coulcil have offered the Esquimalt Water Works Co. $850,000 for their entire holdings including the works at Goldstream, plant in Victoria West and Shetis Lake. A short time ago the company turned down an offer of $900,000. They are given two months to accept or reject the present offer, should they turn it down also, the city will then go to arbitration. This power was given the city at the last sitting of the provincial legislature.

The Kent Farmers' Produce Co., of Blenheim, has awarded the contract for two gas engines of 35 and 20 h.p., respectively, and one 20 h.p. chopper to the Canadian Gas Power & Launches, Limited, of Chatham and Toronto.

Blenheim council has let the contracts for a large tank and pumping station at the electric light power house. J. H. Collar and D. H. Gray, Blenheim, have the tank contract, while Clunis & McIntyre, Blenheim, will supply the complete gas engine and pumping equipment.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe 933-935 Monadnock Block
NEW YORK - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone 1111 Cortlandt

**FRANCE**
PARIS - Agence Havas 8 Place de la Bourse

**SWITZERLAND**
ZURICH - - Louis Wol Orell Fussli & Co

Cable Address:
Macpubco, Toronto - Alabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II JULY, 1909 No. 7


## CONTENTS


City of London, the C.A.S.E. Place of Meeting for 1909 - 17
Fort William's Water Supply - 18
The Twentieth Annual Convention of the C.A.S.E. - - 19
Toronto No. 1 Lodge C.A.S.E. - 21
Hamilton Lodge's Outing - 22
Brampton Lodge No. 36 - 22
Engineers' Club, Toronto - 22
N.S,S.E. Annual - - - 22
Important Development in the Manufacture of Gas Producers 22
Developments in Manufacture of Gas Producers - - 23
Burning Sewage Sludge - 23
Plan for the Purchase of Coal on its Heating Value - - 24
Buy High-Grade Lamps - - 24
Method of Setting the Valves of the Wheelock Engine - 25
North Bay Lodge, C.A.S.E. - 27
Features and Capacities of Boiler Safety Valves - 27
Causes and Cure for Water Hammer in Steam Pipes - 29
Smokeless Combustion of Coal in Boiler Plants - - 31
Definition of Head of Water - 32
Flat vs. Piston Valves - - 32
The 19th Convention of the Canadian Electrical Assn. - 33
Small Central Station; Its Practical Management - - 36
Table for the Design of Governors - - - 37
Saskatchewan's License Law - 38
Power Plant of Shultz Bros. Co., Ltd., Brantford - - 39
Water Softening - - 40
Figuring Cost of Electricity - 40
Patching a Boiler - - 41
Repairing a Broken Pump with Concrete - - - 41
Canada's Water Powers - 41
Opportunities in Canada - 41
Setting a Market Value in a Water Power Plant - 41
Induced Draft - - 43
Practical Articles by our Readers 44
- An Electric Alarm.
- Hot Bearings.
- Leather Belting.
- Curing a Hot Bearing.
- Everlasting Lubricating.
- Some Troubles and their Cure.
- Conservation of Energy.
- A Unique Heating Plant.
- The Injector.
- Some Gasoline Engine Don'ts.
- Automatic Valve for Use with Pneumatic Tools
- Practical Value of Indicator Cards.
- How Should the Valves be Set?
- Smoke Consumer.
- Error of Water Meters.

Correspondence and Discussion on Previous Articles - - 49
- Overworked.
- Is There Any Back Pressure?
- Boiler Explosion.

Editorial - - - - - 50
New Equipment for Power Plants - - - 52
- Automatic Whistle Control.
- Hydraulic Air Compressor.
- Reilly Feed Water Heater

Users of Compressed Air - 54
Book Reviews - - - 54
Catalogues - - - 54
Power Plant Developments - 55
Power Supply Markets - - 56


### THE VALUE OF ASSOCIATIONS.

The interchange of thought on the rapidly increasing problems confronting engineers is making the value of associations felt. No engineer at this date can remain "sufficient unto himself." No individual ever born can see the whole of things from his own angle, or when meditating a certain action, can embrace in his single mind the whole of the consequence. Men whose interests are in the same line derive many advantages from rubbing shoulders with their fellows and exchanging ideas and experiences.

Questions of vital interest to all may be discussed and the opinions of many minds obtained, a thing almost impossible when engineers are thinking separately and at remote distances.

The Canadian Association of Stationary Engineers has been organized with the idea of assisting fellow engineers in obtaining useful information. Lodges have been organized in many centres for the promotion of education. While the greater number of members are in Ontario, there are requests from other provinces for information and the influence of this organization will be more widely felt than in the past. At the lodge meetings, engineers are encouraged to give their experiences, papers are read and discussed, and meetings are addressed by men prominent in the profession. An engineer, therefore, need not remain in ignorance, on any subject on which he desires information.

There is a social element about the meetings also, the value of which would be hard to estimate, but is apparent to all who have had the pleasure of attending conventions of the association. Many engineers, of course will, unfortunately, be prevented from attending the convention to be held in London this month. The editors of The Power House remember those who cannot attend and whose interest in the matters under discussion is just as keen as those who are able to be present. Their interests are our interests and we will endeavor to reflect in The Power House in the best and brightest manner the work of the engineers at the convention.

We recognize that by increasing the knowledge of an engineer, he is capable of a higher position and more valuable to his employer. One way to increase the engineer's knowledge is by keeping in constant contact with brother engineers. It shall be our endeavor, therefore, to keep engineers in close touch with their fellows and keep them informed on all matters pertaining to the art and science of steam engineering.

### PURCHASING COAL ON A THERMAL BASIS.

In this issue appears an article, "Plan for the Purchase of Coal on its Heating Value." It describes a plan adopted by the United States Government for the purchase of coal according to certain specifications, which has resulted in the delivery of a better grade of coal without a corresponding increase in cost.

Many advantages have resulted in adopting the plan of buying according to heating value of coal. Bidders for contracts are placed on a strictly competitive basis in regard to quality as well as price. The trade names for grades of coal has been ignored and eliminated. The government is insured against the delivery of a dirty and poor coal except at a very low price in keeping with the heating value.

The question of purchasing coal on its heating value has been discussed in the editorial columns of The Power House on several occasions. It is an important topic that should interest every engineer and proprietor of a power plant.

The value of a coal is determined by the number of heat units it contains, its moisture and ashes. The heat units are the active matter; moisture and ashes are a detriment. In purchasing coal therefore, allowance should be made for moisture and ashes, as these differ in various coals. The fuel should not be bought on the strength of the results obtained with a test truckload, but on a guaranteed heat-unit basis, which means that the same number of British thermal units are obtained at a given cost. Coal of a perfectly uniform quality cannot be obtained, but the contract may be made in such a way that a proportionate premium is paid if the coal contains more heat units than guaranteed, and a proportionate rebate is allowed if the coal contains less than the guaranteed number of heat units.

This system is fair to both seller and purchaser. The consumer knows that he is getting what he is paying for, as the coal is tested regularly during the year and paid for according to the heating value. The testing should be done by a competent and disinterested party and will be found to give satisfaction to all concerned, the dealer, engineer and proprietor of power plant.

## POWER PLANT ECONOMIES.

While the power plants of some saw mills and woodworking establishments are models of efficiency, with machinery of the highest class there are others in which there is a great waste of fuel, due to the desire to get rid of the shavings and cuttings rather than to secure economy in the power plant.

A study of the obtainable economies in the power plant may result in a saving in the cost of power. By using exhaust steam in dry kilns, means a smaller investment in boilers, for a smaller boiler may be used. There will therefore be less water to pump or buy, less scale to remove, fewer furnaces to fire and rebuild, etc.

Using exhaust steam to heat the manufacturing plant is another obtainable economy. Here again there is less wear on the furnace, less scale, and a saving in water pumped or bought.

Another source of loss is the use of antiquated machinery. The engine may have run steadily for twenty years, but the efficiency of the engine may be exceedingly low. By making a study of the cost of power generation and transmission the engineer and proprietor may find that they can save a great deal of money by installing a new equipment.

An apparent saving in the cost of coal may really be a loss when measured in heat units per dollar spent. Sometimes the buying clerk thinks he is effecting a saving by ordering a cheaper grade of coal, but a comparison of the cost of power revealed by keeping accurately the costs, will show that the saving is only an apparent one. A remedy for this is to buy coal according to its heating value, as explained in an editorial in this issue.

Some engineers have been known to have the drain pipe between the two cylinders of a compound engine connected with the sewer. By a simple arrangement of a tank with baffle plates, seventy-five per cent of the oil used in the high pressure cylinder may be saved and used over again. The baffle plates should be fitted with openings near the bottom through which the water passes. It is drained off through an opening near the bottom of the tank. The oil rises to the top, is skimmed and is used over again.

Numerous little economies will be discovered by investigating. Time spent looking for obtainable economies will more than repay proprietor and operator.

## TOO MUCH AVERAGE MAN.

Did you ever look through a magnifying glass? Things look larger than they really are, don't they? Did you ever come to work in the morning and find work piled around your machine so you didn't know where to start? Or around your desk? You felt like sitting back and letting things take care of themselves, but if you start at one thing, finish it and then start at the next and so on, what a difference it makes. The trouble is, some people will not start. They are forever gazing at a molehill through a magnifying glass. The men who are above the average are the men who do things. They never acknowledge defeat. They never give up. The quitter is a failure. This is the law of life. The man who lets his work conquer him is a quitter.

There are men who have surprised their employers by a change of method, which is due to putting into practice things they have learned by keeping their eyes open. The engineer or clerk who gets in a rut will be numbered among the average men. You cannot change your course if you are in a rut; it allows no development or expansion. Progress requires changes occasionally. A "good enough" method isn't "good enough." What everyone wants is the best. You cannot develop a man with one food; neither can a man be a hundred-point man by walking in a rut. If something works well, try again. You will find something that will work better. The whole development in the mechanical world has been because men who were above the average worked for something better.

The hundred-point man may look like all other men or dress like them, or talk like them, but whatever position he holds, he is true to his trust, he keeps his word and is true to his company. Do your work and do it well. There are too many self-satisfied average men. Aim to be more than the average; be a one-hundred-point man.

## TOPICS OF THE MONTH.

The effort to secure reciprocity in bituminous coal between United States and Canada is, unfortunately for both countries, shelved for the present at any rate. The Finance Committee, through Mr. Aldrich, reported an amendment to the United States Senate, fixing the duty on bituminous coal and shale at sixty cents per ton; or coal slack or culm, at fifteen cents per ton; coke and compositions used for fuel at twenty per cent. ad valorem. A drawback equal to the duty is allowed vessels in the foreign trade. The amendment left out the reciprocity provision of the House of Congress. Numerous attempts have been made to reduce the rate, and there was an effort to obtain free coal, but all were voted down and the committee's scale retained.

* * *

The Canadian Association of Stationery Engineers meet in convention in London on Tuesday, Wednesday and Thursday, July 27, 28 and 29. Every engineer should attend and take part in the discussion of questions that arise. You will have a good time and have an enjoyable outing. You will rub shoulders with your brother engineers and be the better able to take up your work after the exchange of ideas with others in the same profession.

* * *

The annual convention of the Canadian Electrical Association was held in Quebec, June 16, 17 and 18 and it was successful in every respect. All report helpful meetings and papers, a delightful outing, and are warm in their praise of the historic city. A report of this convention appears in this issue of The Power House.

# NEW EQUIPMENT *for* POWER PLANTS

**To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.**

**AUTOMATIC WHISTLE CONTROL.**

The accompanying photograph is of a very ingenious electric and automatic controller and operator for steam whistles and syrens. It is the creation of Mr. Willett Bruce, the superintendent engineer of the White Star Line, and represents a considerable period of experiments and improvements. Its efficacy in the qualities which are claimed for it have been thoroughly substantiated on board White Star liners, and the control and manufacture of the patent has been taken over by Mr. T. Downie, 5 Castle Street, Liverpool.

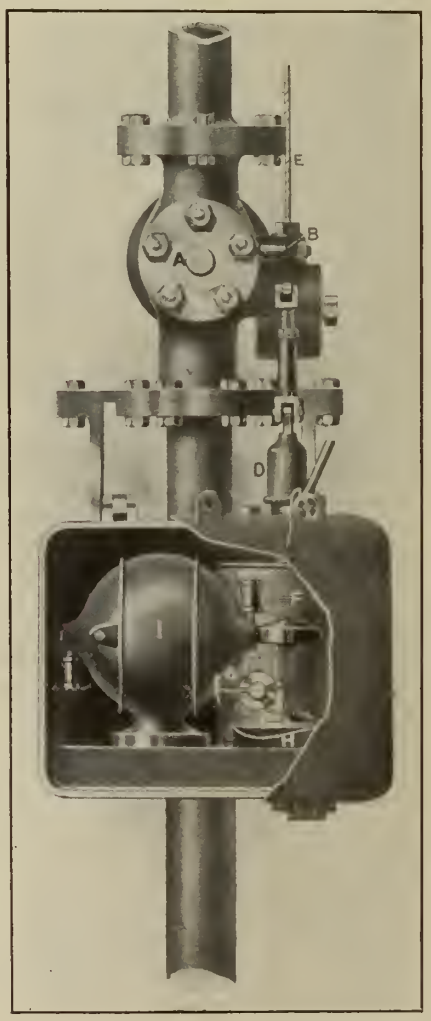
The great importace and desirability of having an efficient and effective equipment so as to ensure clear, distinct, and regular timed whistle blast signals in thick or foggy weather, as encountered by every class of steamer, is apparent.

The photograph shows the valve chest and the box containing the apparatus. This is placed at the foot of the funnel, so that it is easily accessible. Within the box are a small electric motor and the timing switch. The box is only 15 in. long by 13 in. by 12 in. On the right hand side is a hand lanyard which may be used in the event of the electrical gear getting out of order.

The controller may be worked from the navigating bridge by the officer by means of a simple switch. The action is practically instantaneous; the blast powerful, clear, and penetrating. The outstanding advantages of the patent are: Sensitive and absolute control; decisive action; reliability; no condensation in steam pipe exposed to atmosphere; clear and distinct blasts; compactness and accessibility; all the working parts grouped together; and an ordinary lanyard gear independently available at all times and under all conditions.

Owing to the high pressures used, the valve is so designed as to overcome the resistance of the boiler pressure on the opposite side of the valve. In the first instance a small pilot valve is operated, which admits the steam so as to act upon a piston, to the spindle of which is attached the large or control valve, the same distributing the steam to the whistle as desired.

This valve chest is placed at the base of the funnel, or in close proximity to the cravat, and not, as in common practice, at the highest point immediately underneath the whistle dome or domes. Suitable and efficient provision is made to drain the pipe itself from the valve upwards, and thereby avoid condensation or accumulation by leakage in this portion of the piping, which is most exposed, but is so arranged to close when the steam is passing through the pipe, and open when the supply of steam ceases. This can be led into either the waste steam pipe or an exhaust tank, but preferably the former.




Automatic Valve Control.

The automatic timing arrangement is a complete and ingenious one. A suitable electric series wound motor is provided, which has its armature spindle so extended as to carry a worm, which gears into a suitable wheel having a pinion, which in its turn transmits the power to another wheel, having attached to its spindle a radial arm, which in its revolution, as governed by the gearing, comes into contact every 52 seconds, giving a blast of 8 seconds duration or time arranged for, as desired. The motor and gearing are mounted on a slate base plate, which has the necessary terminals placed in the most convenient position. The gearing wheels are run in a small oil bath. Current required for driving the motor and gearing does not exceed 2½ amperes.

The electro magnet is constructed and wound on most recent design, based upon practical experience, being both highly insulated and efficiently protected against damp or moisture.

The watertight casing consists of a light brass box, having a hinged door, which is held in position by suitable screws, while in the flange of the box is inserted a jointing, against which the door is screwed, and thus becomes watertight.

At the back of the box on the outside there are two strong brackets, having suitable flanges for the purpose of attachment to the flange of the steam valve chest. The box is of sufficient proportions to enclose both the motor and automatic timing switch and electro magnet.

The bridge switches are two-way, made of brass and absolutely watertight, having on the cover the words "Time Control" (which is the automatic timing), "Silent," "Signal Control" (which is as desired).

The valve chest being jointed up in the required position on the steam pipe, the casting box, by its brackets, is attached to the projections as arranged on the valve chest's lower flange, and is thus carried up by the steam pipe itself, which overcomes the difficulties of the elongation and shortening of the steam pipe when under steam or off, which, if otherwise arranged, would materially affect the efficiency by the alteration of the distance between the steam chest's lever and the electro magnet spindle.

The whistle control apparatus as described is being placed on the Canadian market by the Hall Engineering Works, 14-16 Jurors St., Montreal. Among the boats fitted with the apparatus are R. M. S. Cedric, Laurentic, Megantic, Lapland, Minnewaska and others.

## HYDRAULIC AIR COMPRESSOR.

This system of air compression consists of an arrangement of pipe, nozzles and tanks by which air is "hydraulicked" from a compressing tank into a pressure tank or receiver.

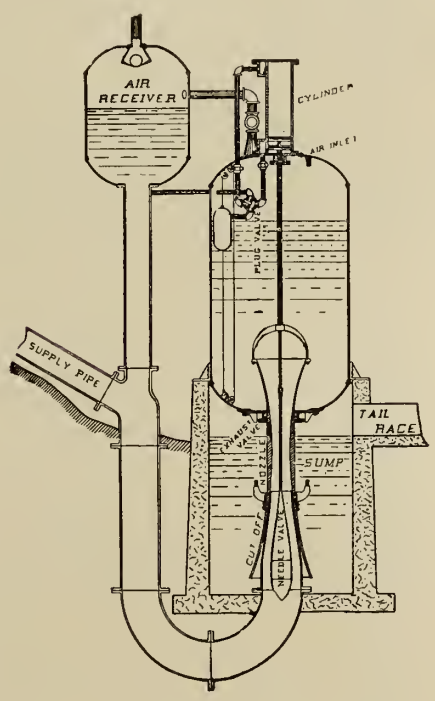
To compress air to 85 lbs. pressure, which is the pressure most commonly used for operating drills and air tools, requires a two hundred foot gravity head of water. If this head were turned directly into a tank full of air, it would compress the air to 85 lbs. pressure and force it out of the tank at that pressure; however, an enormous loss of energy, would take place in the initial stages of compression. To compress the air without loss of energy requires that the water pressure entering the tank should be only slightly greater than the pressure of the air at any given stage, i.e, starting at a couple of pounds pressure, gradually increasing to 16 lbs. pressure when the tank is half full, 46 lbs. when the tank is three-quarters full, increasing thence to the final pressure, 85 lbs. when the tank is 85 per cent. full, then using the full water pressure to fill the remaining 15 per cent. of the tank thereby expelling the compressed air into the receiver. In this system the pressure regulation is accomplished by intermingling various percentages of dead water with the inrushing jet of live water.

A nozzle or monitor connected with a head of water, produced either by gravity or a turbine pump, is mounted under an air tank. By an arrangement of a shifting cut-off nozzle and a needle valve, the stream issuing from the monitor sluices in enough dead water from the sump to reduce the velocity head of the stream entering the tank to the air pressure it must overcome. In the initial stages a small opening of the nozzle sluices in a big stream of dead water from the sump, in the final stage the needle valve gives a full opening of the nozzle, while the cut-off valve shuts off all or nearly all the dead water.

As shown in the illustration, the apparatus consists of a steel tank set over a concrete sump and discharging air into a receiver just above and to one side of it; one branch of the water supply pipe leads to the air receiver and the other to the compression tank; under the tank this branch terminates in a nozzle opened and closed by a needle valve.

The needle valve and the cut-off nozzle are moved up and down by separate pistons set tandem in the reversing cylinder; the movement of the pistons being controlled by a float which operates a plug valve to admit water above or below these pistons.

The cycle of operations is as follows: Starting with a tank full of air, which the receding water level had drawn in through the inlet valves on top of the tank, the float now at the bottom of the tank has already pulled the handle of the plug valve up and this valve directs the water pressure into the upper port of the cylinder. It will be noted that this port is double and the lower opening is covered by a check valve, the water entering the upper port cause both pistons to simultaneously move downward, the speed being regulated by the opening of the plug valve, by adjusting the lower tappet on the float wire, the float will give the desired opening. When the pistons have decended about six inches, the exhaust valve previously raised by the ascending cut-off nozzle, closes and the needle valve begins to let water out of the nozzle In the initial stages the needle valve would only




McFarlane Hydraulic Air Compressor.

admit a small quantity of high pressure water and the cut-off nozzle would admit the maximum quantity of dead water. As the air pressure in the tank increased, the opening needle valve and descending cut-off would also increase the water pressure. The curves of the needle valve and cut-off are designed so a uniform downward motion will give the required admixture of dead and live water to give the inrushing jet of water a velocity head just sufficient to overcome the air pressure in the tank. When the air reaches the desired degree of compression it is discharged through a pipe with a down-closing check valve into the air receiver; during this period, while the nozzle is wide open, a portion of the water in the receiver displaced by the inrushing air is forced down the supply pipe into the compression tank. Before the air is entirely expelled the rising float reverses the plug valve, throwing it wide open; the water pressure is now directed into the lower port of the cylinder; now the bottom of the lower piston is below the port and the water pressure acts on the upper piston alone, to quickly raise the needle valve and shut off the nozzle. The upward motion is hastened by the pressure behind the needle valve; near the end of the upstroke a dog nut on the valve stem engages the bottom of the hollow stem of the cut-off nozzle, raising it enough so the water pressure catches the lower piston, as it travels upward the water above the piston passes out through the check valve covering the bottom opening of the upper cylinder port. The instant the cut-off nozzle moves up the water in the tank begins to discharge through it; a few inches from the upper limit of its travel it also lifts a large exhaust valve in the bottom of the tank, which empties the tank very fast.

Each cycle would require ordinarily about fifteen or twenty seconds to complete, and a nearly constant air pressure would be maintained in the pipe line throughout the cycle by the water level in the air receiver rising and falling.

While the special field of this hydraulic system is direct compression from natural heads of two hundred feet and over, it can be used advantageously with an artificial head produced by a turbine pump.

This compressor was designed by George C. McFarlane, 312 Bearinger Bldg., Saginaw, Mich.

---

## REILLY FEED WATER HEATERS.

Peiler & Mackenzie, Montreal, have been appointed general sales agents for the Griscom-Spencer Co., New York, makers of the Reilly Multicoil Feed Water Heaters and Condensers. As can be seen from the cut of this heater, the construction offers many advantages. The feed water is forced through a series of copper coils each of which is 24 feet in length and coiled on a 2-inch radius. These coils are connected to the headers by standard screwed ground-union joints which are readily accessible through a large door in the shell. Any coil may be replaced by the engineer in a very short time with no tool but a wrench.

The special advantages claimed for this heater are:—

(1.) Its high efficiency, owing to the fact that the water in passing through the spiral coils is violently agitated and every particle is repeatedly brought into contact with the hot tubes. (2.) Its continuous high efficiency due to the fact that this heater will not scale up, because the copper tube walls are smooth, the radius of the coil is small, the centrifugal force of flow is great and the consequent scouring action of the water in

the coils positively prevents scale from fastening to the smooth tube-walls. (3.) The heat is not heavy and is easily repaired. For equal capacities this heater

Reilly Feed-Water Heater.

is about one-third the size and weight of any other in the market. No other heater is so easily repaired in case of accident.

For example, the Reilly Class Y. No. 2 Heater, with a guaranteed capacity of raising 3,600 lbs. of water from 50 F. to 210 or within 2 of the temperature of the exhaust steam (whether under pressure or vacuum) i.e. 120 H.P. rated capacity, has a diameter of 13½ inches and an extreme height of 4 feet 3 inches and weighs less than 450 lbs.

A Reilly 300 H.P. heater of the same efficiency only measures 17 inches x 4 feet 2⅝ inches in height and weighs only 825 lbs. This same heater has a guaranteed efficiency of 500 H.P. from 50 to 195 F.

The Reilly heaters are only sold to specification, and with the makers' guarantee to fill the requirements as stated to them. Messrs. Peiler & Mackenzie have a catalogue with detailed particllars, which is free to all engineers.

## USERS OF COMPRESSED AIR.

Compressed air has been applied to advantage to facilitate many operations in the plant of the Plymouth Cordage Company, Plymouth, Mass. Some of these operations are of importance in the successful carrying on of the work, others are of minor value. It is undoubtedly true that all can be carried on satisfactorily through the use of some other medium than the compressed air, either steam, electricity, or mechanical connection, as in each particular case might be found most practical and advantageous.

Collectively, however, the various ways of using air in the plant work out nicely from the standpoints of simplicity, safety and economy, and show convincingly the superior merits of compressed air as a medium of power transmission in work to which it is adapted.

The most important use made of compressed air at this plant is in its traction system. Five locomotives are in use. These locomotives have 5 x 10-inch cylinders, two coupled 24-inch drivers, a single storage tank four by eleven feet, with a capacity of 132 cubic feet, and weigh 8,500 pounds each. There are twenty-six cars with five by twelve-foot tops, which are carried by four twenty-inch wheels and weigh 2,000 pounds each. The track is run about the yard, into or through buildings, many of which are filled with inflammable material, with no danger from fire. A consideration of this single feature has convinced us that the steam locomotive is barred and the electric motor has a serious handicap in comparison.

The cost of repairs is very slight. The first locomotive at our Plymouth plant was purchased in 1876 and is, and has been in active service continuously through its thirty-two years' of life, with a surprisingly small amount spent on it for maintenance.

The next use in importance made of the compressed air is in the handling of raw material in the store houses. Ordinary steam hoists are adopted; the valves are tapped into the air main at each desired location, and to these valves the engine is connected with a six-ply wire wound rubber hose. As the engine is on wheels it is readily moved from one section to another of the storehouses and quickly attached to the air main. The arrangement is perfectly safe, even where there is some inflammable material, is clean, easily handled and cheaply operated and maintained.

---

The surface of a sphere equals the diameter multiplied by itself and the product by 3.1416.

---

### Cost of Street Lighting.

The following is a table of the cost per light per year, of street lighting in a number of Canadian cities, some under municipal ownership and others served by private companies :

| | |
|---|---|
| Brantford (private) | $ 48.00 |
| Ottawa (municipal) | 45.00 |
| Fort William (municipal) | 45.00 |
| Hamilton (private) | 47.50 |
| Port Arthur (municipal | 48.00 |
| St. Catharines (private) | 50.00 |
| Peterboro' (private) | 50.00 |
| Pembroke (private) | 50.00 |
| Owen Sound (municipal) | 51.00 |
| Montreal (private) | 60.00 |
| Guelph (municipal) | 60.00 |
| Kingston (municipal) | 60.00 |
| Sherbrooke (private) | 60.00 |
| Quebec (private) | 62.10 |
| Brockville (municipal) | 62.50 |
| Halifax (private) | 65.00 |
| Toronto (private) | 69.35 |
| Galt (private) | 75.00 |
| St. John's (private) | 75.00 |
| Cornwall (private) | 82.12 |
| London (private) | 83.95 |
| Niagara Falls (municipal) | 85.00 |
| St. Thomas (municipal) | 91.25 |
| Calgary (municipal) | 156.00 |

## BOOK REVIEW.

ENGINEERS' HANDBOOK. — Published and presented by the Erie Engine Works, manufacturers of engines and boilers, Erie, Pa. A 90 page book given free to all engineers sending for it. It is brimful of good, useful information dealing with power generation and transmission, belting, setting valves, dynamos, motors, steam engines and questions of steam expansion, etc., rules for calculating the speed of pulleys, babbiting bearings, and boilers, with useful information in regard to boilers. The chance to secure this useful volume should be taken advantage of by every engineer as it will be found very valuable as a book of reference.

PRACTICAL CALCULATION OF TRANSMISSION LINES—93 pages, all necessary tables given, by L. W. Rosenthal, E.E., published by McGraw Publishing Co., 239 West 39th St., New York. Price $2.00 net.

This book is a practical help in the rapid and accurate calculation of transmission lines. The book covers methods of calculations. It is divided into five chapters as follows : Chapter I, Direct-current distribution for light and power ; II. Distribution for direct current railways ; III. Alternating-current transmission by overhead wires ; IV. Alternating-current transmission by underground cables ; and V. Interior wires for alternating-current distribution.

All chapters, except V, include the important effects of temperature and specific conductivity. The chapter relating to direct-current railways is novel in the form of its tables, and the methods outlined in it have been found rapid and comprehensive. The alternating-current division presents a new and original method for the solution of these problems. It possesses unique features of scope, accuracy and simplicity. The chapter on single-phase railways is in accord with the most consistent data published on the subject.

---

## CATALOGUES.

OILDAG—From Acheson Oildag Co., Niagara Falls, N.Y., catalogue and price list of oildag paste for engines.

EXHAUST FANS—From Crocker-Wheeler Co., Ampere, N.Y., bulletin 112 describing their ventilating fans with motor attached. These are for use in offices, churches, factories, etc.

INDUCTION MOTORS—Bulletin No. 102 from the Packard Electric Co., St. Catharines, Ont., describes in detail the Packard Electric induction motor adapted for all classes of industrial drive.

BOILER COMPOUND.—Booklet from Hygienic Laboratories, 11 Colborne St., Toronto, describing Red Star Boiler compound and directions for using it. It also describes the Red Star Boiler compound feeders.

TRANSFORMERS.—Large transformers for electric smelting, the details of construction, etc., are described in an illustrated booklet published by the Packard Electric Company, of St. Catharines, Ont. Description of installations at Welland and Niagara Falls are also given.

BATTERIES.—A valuable catalogue from the Gould Storage Battery Co., 341-347 Fifth Ave., New York City, illustrating and telling of the Gould battery in isolated lighting plants of moderate size. The catalogue tells of the use and value of the storage battery in these plants and their operation with the necessary explanatory diagrams.

STANDARD CROWN VALVES.—Booklet from the Standard Engineering Co., Toronto, illustrating and describing in detail the "Standard Crown Valve," which has some valuable features. The booklet contains also a price list of the valve.

PIPE CUTTING AND THREADING MACHINERY.—A 36 page catalogue from Curtis & Curtis Co., corner Railroad Ave. and Gordon St., Bridgeport Conn., manufacturers of the Forbes' Patent Die Stock. The pipe cutting and threading machinery is described and illustrated and prices are given for the various sizes of hand and power machines.

FIREBRICK—From Harbison-Walker Refractories Co., Pittsburg, Pa., illustrated catalogue for 1909, 158 pages, coated paper, gilt edges, leather bound. Silica, magnesia, chrome and fire clay brick and various refractories are fully described. The catalogue is well illustrated and the construction of fire brick linings in cupolas, boiler settings and various furnaces is shown. The catalogue will be sent to foundry foremen applying for it.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Electricity and Steam.

Regina will spend $78,000 for electric light purposes.

Bridgetown, N. S., will instal a new system of lighting.

The municipality of Albert, Man., has voted in favor of a municipal telephone system.

The Dominion Coal Co. will equip its colliery at Glace Bay, N.S., with an electric plant.

The ratepayers of Claresholm, Alta., have passed a by-law to raise $20,000 for a lighting plant.

The Foster Rural Telephone Co., Abernethy, Sask., has been incorporated with a capital of $5,000.

The Central Ontario Power Co.'s offer of power at $7.50 per h.p. to Peterboro will likely be accepted.

Engineer P. W. Southam recommends the purchasing by the Waterloo, Ont., council of the local lighting plant.

The ratepayers of Shelburne, N.S., have decided to instal an electric lighting and power plant at a cost of $30,000.

Hamilton ratepayers carried the Hydro-Electric by-law by a majority of 610 and turned down the Cataract agreement by a majority of 185.

The rural municipality of Wallace, Man., has passed a by-law to raise $20,000 for the construction of telephone lines within the municipality.

The Great Falls Power Co. desires to make a contract with Portage la Prairie for the supply of power at $21 per h.p. for a period of 30 years.

M. Conroy, of Aylmer, Que., representing a power development company on the Gatineau river, has offered to supply Brockville with 20,000 h.p.

McGill University, Montreal, is to instal a large power plant, to furnish steam heat and electric power to all of its buildings. The plant will cost $150,000.

The Seymour Power & Electric Co. want to sell power wholesale to Peterboro. They will be able to develop 4,000 h.p. in August and ultimately 20,000 h.p.

Hamilton city council has accepted the offer of the Hamilton Electric Light & Power Co. to furnish electricity for the illumination of Gore Park until September 30 for $550.

The Toronto Board of Control has awarded the contract for lighting the newly annexed district of Wychwood to the Toronto Electric Light Co. at a rate of $69 per lamp per year.

The Thamesville Telephone Co. has been incorporated with a capital of $10,000. The provisional directors are: W. J. Mitton, Camden; T. Marven, J. Coutts, Thamesville, Ont.

The Canada Mining Co., a company capitalized at 250,000 recently organized by P. H. Moore, of Bridgewater, for the purpose of developing power for mining purposes from the Salmon Falls on the Medway river, N. S.

Fernie city council has accepted tenders for the construction of pole line distribution and machinery, also for the removal of the machinery from Coal Creek and its installation in Fernie, in connection with the municipal electric light system.

Provision is made for additional construction and enlargements, amounting to $4,000,000, to the Canadian Niagara Power Co.'s plant by a bond issue of $25,000,000 authorized by the stockholders of the Niagara Power Co., the parent company of the Canadian Niagara Co.

The Alberta Government has entered into an agreement with the Automatic Telephone Co., Chicago, Ill., to instal automatic telephone systems in East Calgary and Lethbridge. It is understood that similar equipment will be placed in other cities in the province during the summer.

The first units of the great hydraulic power plant at Fort Frances, will likely be turned on early in August next. Orders have been placed for a quarter of a million dollars' worth of machinery, and in addition to this $150,000 worth of electrical apparatus has been contracted for.

The Western Canada Power Co. is the title of the corporation which has taken over the works and assets of the Stave Lake Power Co., Vancouver. The company will have a capitalization of $5,000,000. It is backed by Montreal men among whom are a number of the strongest capitalists in Canada.

The Great Falls Power Co. plans to distribute electrical power to the amount of 180,000 horsepower in Manitoba. They have acquired falls on the Winnipeg River that give a total head of 50 feet. The company has backing to the extent of $600,000. The transmission lines already plotted cover 63 towns.

The Goat River Power & Light Co., Creston, B. C., proposes to construct a power plant on the Goat River Canyon and will furnish electricity for lamps and motors and other purposes. The company also plans to construct an electric railway to extend from Creston to the Goat River, ten miles in length, work on which will commence within a year. R. S. Lennie, of Nelson, B.C., is president.

It is given out on good authority that the settlement out of court in the action against the Electrical Development Co. brought by the Niagara Construction Co. for flooding of its plant at Niagara Falls, consisted of a payment by the Electrical Development people of $15,000. The Construction Co. claimed $109,000, and the Electrical Development Co. offered $10,000, and finally $15,000, which was accepted.

Rodolphe Forget, M.P., who is the moving spirit in a big Quebec merger scheme, which will include electric, gas and street railway companies of that city, with a capital of $5,000,000, when asked for further details as to the new merger, said that it was the intention of the gentlemen in control of the Quebec Street, Power & Light Co. to make it one of the best corporations of its kind in the country.

The electric light superintendent has intimated to the Regina council that unless the new generators which it is proposed to instal are in position by September, it will be necessary to consider refusing to make new connections with the city's lighting system, or else to curtail the street lighting during the early evening hours in the fall, when the load upon the power house plant is heaviest. At the present time the plant is working in excess of its capacity.

D. W. Yates, Hydro-electric Commission's engineer has submitted to the city council of St. Thomas the estimates of the cost of constructing a plant for the distribution of Niagara power. For an entire new plant for all purposes his figures were $83,620, with alternate propositions which would mean the remodelling of the present plant for $82,810. The council decided to accept the former proposition, and will ask the ratepayers to sanction the expenditure.

The directors of the Northumberland-Durham Power Co., have announced that the Minister of Railways and Canals has agreed to grant a lease to the company of the remaining portion of the Healey Falls waterpower controlled by the Federal Government. Development of the power will proceed concurrently with the construction of the Trent Valley canal which passes through the Company's property, and will also facilitate the early construction of the Cobourg, Port Hope and Havelock Electric Railway.

The Manitoba telephone commissioners have completed plans for the season's programme of building and extensions which will mean the expenditure of $750,000 and the addition of 5,000 subscribers to the system in Manitoba. $250,000 will be spent in Winnipeg upon a new exchange for the western part of the city; for the extension of aerial and underground cables, and also the necessary extensions to be provided for the Main Street and Fort Rouge exchanges. There will be $250,000 expended on rural lines, and $250,000 on long distance lines.

The City of Toronto will shortly call for tenders on approximately the following apparatus:—Two 1,500 H.P. Induction Motors, direct connected to turbine pumps; Four 1,500 H.P. Synchronous Motors, with turbine pumps; Four 500 H.P. Synchronous Motors, with turbine pumps; Two 500 H.P. Induction Motors, with turbine pumps; Two 300 H.P. Induction Motors, with turbine pumps; two 225 H.P. Synchronous Motors, with turbine pumps; together with valves, piping bed-plates, couplings, switchboards, connecting material, etc. For information apply City Engineer's Department, Toronto, Canada.

Contracts for the construction of the municipal electric light plant at Lethbridge have been awarded as follows: For mechanical grate and economizer to the Polson Iron Works, Toronto, Ont., $6,890; complete piping, Drummond, McCall & Co., Montreal, Que., $14,365; for crane to Mussens, Limited, for $1,700; boilers and accessories to the Babcock & Wilcox Co., Montreal, $25,410; feed pumps to the Canada Foundry Co., Toronto, $750; transformers to the Northwest Electric Co., Calgary, $1,320; electrical equipment to the Canadian Westinghouse Co., Hamilton, $1,449, and to Laurie & Lamb, Montreal, for engine and condensing sets for $18,575.

### Gas Items.

The Gas Traction Co., will erect a plant to manufacture gasoline engines in Elmwood, Winnipeg. Cost $75,000.

Glencoe, Ont., is installing a 100-horse-power Hornsby-Stockport suction gas engine unit for street and domestic lighting.

The City Gas Co. is prepared to deliver natural gas in London, just as soon as a proposition that would meet with the citizens' indorsation is presented.

The Calgary Natural Gas Co. has decided to begin work immediately on a second well near their present well, and the order has already been given for the machinery.

The Goold, Shapley & Muir Co., Brantford, installed an 8 horse power gasoline engine at that city's waterworks to replace the windmill wrecked in the storm a few weeks ago.

A number of Detroit capitalists recently visited Sarnia and had a consultation with representatives of the Gas & Electric Light Co., relative to supplying the town with natural gas. It is the intention of the promoters of the scheme to pipe natural gas to Sarnia from the oil and gas fields near Tilbury and deliver it to the local company for distribution to patrons. The cost of bringing the gas to the town would be in the neighborhood of three or four hundred thousand dollars.

Crossley Bros., the well-known gas engine builders of Manchester, England, who have made a number of Canadian installations announce that in addition to supplying producer gas plants for utilizing bituminous coal, lignites, coke, sawdust, shavings, charcoal, etc. they have now designed a gas plant for utilizing the smoke box char which is usually taken from the smoke box of locomotives; similar material being also taken from the residue from blacksmiths' hearths, and the like. This plant has been put to practical use, and is now offered as a commercial proposition in a number of standard sizes.

### Trade Notes.

The Sheppard Lumber Co., Wauhaushene, Ont., have ordered a duplex Outside Packed Plunger Pump with Pot Valves, from the Smart-Turner Machine Co., Limited, of Hamilton, Ont.

The new factory for the Canadian Spool and Cotton Co., Montreal, is being equipped with panelhoards and cabinets, manufactured by the Hill Electric Switch and Mfg. Co., 1561 St. Lawrence Boulevard, Montreal.

C. B. Turner & Co., Box 254, Toronto, have installed two Myers automatic boiler cleaners in the boiler room of Shultz Bros., Brantford. They have also received orders from the Continental Mexican Rubber Co., Torreon, Coahuila, Mexico, who have a power plant with twelve boilers. An installation was recently made by Mr. Turner in the Gutta Percha & Ruhber Co., Toronto, which has been giving satisfaction.

---

### Organ Feed Water Heater.

The Owen Sound Iron Works have arranged to place on the Canadian market the Organ feed-water heater and purifier. It will be manufactured by them at Owen Sound. An illustrated description will appear in an early issue of The Power House.

## Peat for Gas.

A contract has been awarded for the construction of an experimental plant at Ottawa to be used by the Mines Branch, under Dr. Haanel, for the purpose of ascertaining the value of peat in making producer gas. It is held that peat can be made for smelting and other fuel purposes. The station will cost about $13,000. The contract has been given to Doran & Devlin, Ottawa.

## Bearing the World's Load.

This is the title given to a book issued by the Chapman Double Ball Bearing Co., Toronto, describing the various applications of the Chapman double ball bearing. The development of the principle of double ball bearings and the uses are well illustrated. Among the machinery where double ball bearings are used to reduce friction are line-shaft and counter-shaft bearings, motors, waggons, machine tools, street cars, shop trucks, mine trucks, automobiles, etc. The story is told in a way that should interest every proprietor superintendent, foreman and master mechanic.

## Cobalt Power Development.

Mining in Cobalt will be simplified to a great extent when the Cobalt Hydraulic Power Co. is able to drive drills, with air pressure from Ragged Chutes, on the Montreal River.

Nine miles of 26 inch pipe will be required to bring this air flow into camp and 12 inch loop line will start at the La Rose bridge, circle the entire town and join the main piping. In addition to the loop there will be branch lines, by way of the Colonial and Nova Scotia and another line will run to Kerr Lake. At Cobalt there will be about 110 lbs. pressure and will be charged for per that pressure.

To the larger consumers the air will be supplied by meter, the terms of which will be 25 cents per thousand cubic feet of compressed air at 100 lbs. pressure, which will be measured by the meter similar to the system used by gas companies in the big cities.

To the small consumers, who will pay for pipe connection from premises to main pipes, the following rates will be charged, per drill per 10-hours shift: 1 drill, $5; 2 drills, $4; 3 drills, $3.50; 4 drills, $3.13; 5 drills, $2.80; thus varying from $5 per shift per drill to $2.80 per shift per drill for five drills or more.

Five million pounds of pipes, bolts and other material will be required to carry out the scheme. A great deal of this material was received from Germany.

The transmission line for the electric power from Fountain Falls will be ready for use shortly. The rates charged will be under 25 h.p. 3c. per kilowatt hour, as figured by Watts meter.

For 25 h.p. and under 50 h.p., 2c.
Over 50 h.p. and under 200 h.p., 1½c.
Over 100 h.p. and under 200 h.p., 1 5-10c.
Over 200 h.p. and under 300 h.p., 1 4-10.
Over 300 h.p. and under 400 h.p., 1 3-10.
Over 400 h.p. and under 500 h.p., 1 2-10c.

Over 500 h.p. will be 5c. per kilowatt hour and in addition to these rates there will be a charge of $1 per month per horse power on the rated capacity of the installed motors. The bills to be reduced by a discount, having a maximum of 13 per cent. based on the load factor.

## Point du Bois Generating Station.

Sealed tenders on prescribed forms addressed to the Chairman of the Board of Control, Winnipeg, Canada will be received at the office of the undersigned up to 11 a.m. on Monday, August 2nd, 1909, and Monday, August 16th, 1909, as below, for the manufacture, delivery and erection of the hydraulic, electric and auxiliary equipment of the Municipal Generating Station on the Winnipeg River.

The specifications and plans will be on exhibit after June 15th at the office of the following:—Engineering, London, Eng., Engineering News, New York City, Smith, Kerry & Chace, Toronto, Wm. Kennedy, Jr., Y.M.C.A. Building, Montreal, and Smith, Kerry & Chace, Winnipeg.

Copies of the instructions to bidders, of the plans, specifications and form of tender, may be obtained from the Power Engineer's office, Carnegie Library Building, Winnipeg, and at the office of "Engineering", London, Eng., after June 15th, but the application for these must be accompanied by deposit, as listed below, for each section applied for. This deposit will be returned to the applicant only upon the return to the Power Engineer's Office of the plans and specifications in good order.

Each tender must be accompanied by a certified cheque payable to the city treasurer for the sum called for in the corresponding instructions to bidders, which cheque will become forfeit to the corporation in the event of the successful tenderer refusing or neglecting to execute a satisfactory contract when called upon so to do.

Tenders will be received upon the following sections:—

*A.—Specifications Nos. 5 and 6 respectively for 5200 h.p. turbines (5), 450 h.p. turbines (2), deposit $250. *This tender returnable August 2nd, 1909.

B.—Specifications Nos. 7, 8 and 11, respectively, for 3000 K.W. Generators (5), 250 K.W. Generators (2), switching and accessory apparatus. Deposit $250.

C—Specification No. 10 for Step up Transformers (6). Deposit $100.

D.—Specification No. 12 for light, heat and power systems. Deposit $50.

E.—Specification No. 23 for protective apparatus. Deposit $50.

F.—Specification No. 25 for electric travelling cranes (3). Deposit $50.

G.—Specification No. 27 for auxiliary apparatus. Deposit $100.

As an alternative, tenderers may include or group together one or more of the above section providing that they have also tendered for the individual sections of such grouping.

## Big Shipbuilding Plant.

The Polson Iron Works Co., have applied to the city of Toronto for a lease of fifty acres of land at the east end of the bay, near Keating's cut, and it is their intention to enlarge and improve their plant, which is now situated at the foot of Frederick Street. A general shipbuilding plant will be installed on a large scale, and in connection with it there will be a floating drydock capable of taking in the largest of the lake-going vessels. The drydock is to be built in sections, and when the Welland Canal is deepened, which is shortly to be done, the drydock is to be further enlarged.

## Canadian Westinghouse Busy.

The Canadian Westinghouse Co., Hamilton, are preparing to supply their part of the Hydro-Electric power scheme equipment, the contract for which was devided between the Canadian General Electric and the Canadian Westinghouse. The latter company will completely equip the main station at Niagara Falls, the main switching station at Dundas, the sub-stations and protective apparatus. Work on the apparatus is being started at once and will extend over ten months. The Canadian Westinghouse expect to increase their staff at an early date to take care of this contract and others that are on hand.

## Manchester Civic Gas Plant.

Municipal ownership of the city gas plant has been proven to be not only a profitable undertaking for Manchester, England, but economical for the consumer as well. The city's profits since the works were taken over 25 years ago, have been $6,750,375, while the price of gas in Manchester district at present is only 55 cents per thousand cubic feet, according to a report to the Bureau of Manufactures, from United States Consul Howe. To illustrate the growth of the business, it is stated that the producing capacity of the works is 26,900,000 cubic feet per 24 hours, against 13,000,000 in 1883. An investment of $13,382,875 capital is represented. Manchester has a population of about 600,000, being about the size of Boston and St. Louis.

## Another Big B.C. Power Concern.

At last it appears as if there will be something done with the proposition of the Stave Lake Power Company on Stave river, about thirty miles from Vancouver. For some years past, development of this waterpower has gone on slowly, but it is now announced that work will be active since eastern Canadians are to put up $2,500,000. C. H. Cahan, a leading lawyer of Montreal and Halifax, A. R. Doble and A. M. Aitkens, of Montreal, are spending a couple of days at Stave river, looking over the property. Just what this will ultimately mean to the lower mainland of British Columbia is difficult to prophesy. With other and cheaper power producing methods coming into vogue, by the time this is ready for operation, waterpowers may have taken second place. This, however, is only supposition. Still, the situation in Vancouver and vicinity will be an interesting one with two companies in the field. The B. C. Electric Company now controls lines of railway in Vancouver and New Westminster, and suburban and interurban lines, including the one under construction to Chilliwack. It controls the electric lighting and gas franchise in Vancouver, and the electric lighting in and around both cities. It also supplies power, all of which comes from the large plant at Lake Buntzen, which is to be so improved as to give much more power. With such a hold on the communities, it will be a hard job for another company to get into the game. It has been stated that the Stave Lake Power Company will make a specialty of supplying power for industrial purposes, and in this line there will be considerable room with the number of large and small enterprises that are being established. With more companies in the field, the better it should be for the manufacturer, who can stand all the cheap power he can get.

# Power Supply Markets

## VANCOUVER.

The motor car business has been particularly brisk this season, with a little slackening up of late. Real estate was active in the earlier part of the year, with the result that much money was made quickly. This, combined with general good conditions in the way of business in general, is the cause for the buying of many automobiles.

Mr. McIlleny, manager of the Crane Co., successors to Boyd, Burns & Co., appeared before the civic Water Committee on Wednesday afternoon and registered a protest against the recent award for water pipes. He claimed that his company's tender was the lowest, being $40.78 per 100 feet for two and a half miles of 6 in. No. 10 gauge steel, while the figures of Robertson, Godson & Co., the successful tenderers, were $43 for practically the same size and quality. He explained that the statement had been made that tapping saddles for his pipe would cost $4 each, but the cost would be only 60c. After consideration with the waterworks superintendent, the committee decided to adhere to the original award.

## TORONTO.

Dealers and engineers are of the opinion that trade is increasing. The demand for power machinery is good and municipalities that have water powers in their vicinity are planning for municipal electric lighting or making arrangements for its supply.

Manufacturers are preparing for a very busy manufacturing season. The General Electric and Canadian Westinghouse anticipate one of the busiest seasons they have had, partially on account of the large orders from the Hydro-electric Commission.

BOILER TUBES—Orders continue about the same. Lap welded steel per 100 ft., 2-inch, $8.50 to $8.75; 2½-inch, $10 to $10.75; 2½-inch, $10.75; 3-inch, $12.00; 3½-inch, $15, and 4-inch, $18.50 to $19.00.

BELTING—Orders are good and prices firm. The rise in price of hides has not affected leather belting as yet.

LEAD WOOL—Demand is good with price stationary at $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35; American, $27.50 to $35 per 1,000.

## WINNIPEG.

Business generally is good with prospects for a large autumn trade. The western cities are alive to the needs of electric lighting plants and pumping stations and a great number are under way, either being planned or under construction.

LUBRICATING OILS—600 W. cylinders, 80c; Maple Leaf cylinder, $1 per gal., 700 A. cylinder, 75; Sterling cylinder, 55c.; Eldoral Castor, heavy, 27c.; medium, 26c.; Standard Gas engine oil, 36c.; Supreme engine oil, 50c.; Empire cylinder, 54c.; Royal gas engine oil, 50c.; Century castor, 28c.

GASOLENE—Demand is good. Engine gasolene, 22½c.; White Lily, 23c.; Royal, 22½c.

## HALIFAX.

Collections are reported to be very good. The returns from lumber in its various forms, makes an appreciable difference in the situation. The big corporations are complained of as being slow to pay however. The increase in the output of the mines, improvement in the fisheries, and better weather conditions on the farm are having a beneficial effect upon trade generally. As a consequence money is circulating more freely.

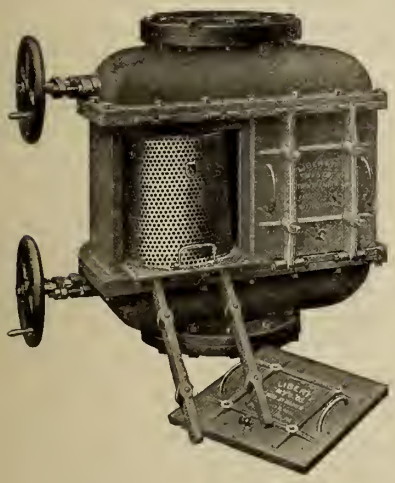
The steamer Marien, which arrived here this week, brought 520 tons of cast iron pipe for the City of Halifax. The pipe is part of a purchase of $18,000 made in Scotland, and will be used for the extension of the water service.

# You can't afford to Stop—

to shut down the whole plant—while you laboriously scrape the mud out of pumps, valves, condensers, etc.

That's why you need the

# "Liberty" Twin Strainer



THE "LIBERTY" TWIN STRAINER.

With this modern attachment your plant can run continuously.

By the shifting of two gate valves, which form integral parts of the device, one of the basket-like strainers may be removed, cleaned and replaced, while the water continues its flow through the other.

Its construction is exceedingly simple; and surprisingly little alteration of piping is necessary for its installation, as it operates equally well in any position.

In Power Plants where a constant flow of water is essential, the Liberty Twin Strainer is absolutely indispensable.

This Twin Strainer is only one of a great many

## "LIBERTY"

Modern Power-Plant Appliances.

The two cuts on the right show two of the "Liberty" Tube Cleaners, the superior efficiency of which has been demonstrated beyond the shadow of a doubt.

There is a host of other Power-Plant-Trouble-Killers shown in our complete catalog, a copy of which will be gladly mailed to you on request.

WRITE FOR IT TO-DAY!

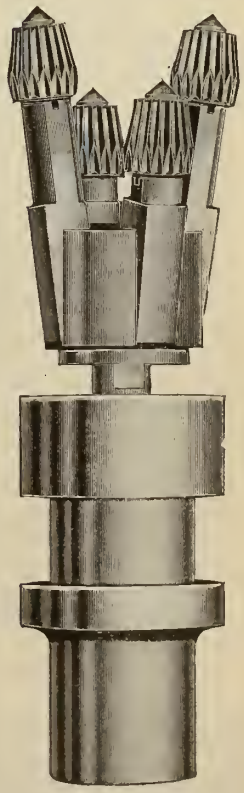
THE

## Liberty Manufacturing Company

6902 SUSQUEHANNA STREET

**Pittsburg, Pa.**

The "LIBERTY" Turbine Tube Cleaner



The "LIBERTY" CYCLONE Tube Cleaner

# ELECTRIC BARGAINS

7½ H.P. Motor (Westinghouse)
3 " " "
3 " " (C.G.E.)
15 " " (Kay)
20 " " (United
175 Light Dynamo (Eddy)
Century Single Phase Motor

We manufacture alternating and direct current motors in all sizes. Repairs promptly performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Toronto, Ont


## MISCELLANEOUS.


AN EXTRA 1 PER CENT. PROFIT.—A National Cash Register will earn at least an extra one per cent. profit for any retail merchant. The National Cash Register Co., F. E. Mutton, Canadian Manager, cor. Yonge St. and Wilton Ave., Toronto, Ont.

ACCURATE COST KEEPING IS EASY if you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe a time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited. Office and factory, 27 Alice Street, Toronto. (tf)

ELLIOTT-FISHER STANDARD Writing-Adding Machines make toil easier. Elliott Fisher Limited, 513, No. 83, Craig Street W., Montreal, and 129 Bay Street, Toronto.

CUT DOWN YOUR PRINTING BILLS one half by installing a "Writerpress." Your office girl or boy can with it print your circulars, price lists, etc., at the rate of 1500 to 2000 copies per hour. Best machine ever made for printing facsimile typewritten letters. Prints from printers' type, half-tones, etc. Retail stores could greatly increase their business by using a Writerpress to run off circulars and letters, sending them out to their customers and probable customers announcing special sales, etc. Send for illustrated catalogue and samples. The Canadian Writerpress Company, 33 John St. South, Hamilton, Ont. (tf)

NOTICE!!—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts for the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ont. (tf)

SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling, and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD


### FACTORY PRODUCTS LIMITED.

H. C. Nicholls, who has for several years been Assistant General Manager of the Canadian General Electric Company and the Canada Foundry Company, has resigned that position in order to go into business for himself. He has organized a company called "Factory Products Limited," with offices in the Confederation Life Building, Toronto, for the purpose of acting as Canadian selling agents for representative manufacturers.

### HIGH SULPHUR COAL FOR THE MANUFACTURE OF GAS.

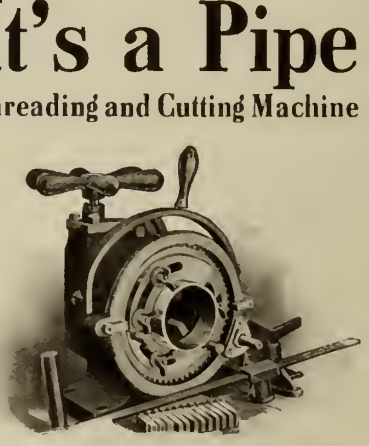
Recent investigations conducted by Arthur D. Little, chemical expert and engineer, of Boston, to determine the effect of sulphur in illuminating gas have brought out some interesting facts regarding the relation between the amount of sulphur in coal and its availability for use in the production of gas under existing legal restrictions. In his report Mr. Little shows that the amount of sulphur contained in gas is naturally a function of the percentage of sulphur in the coal from which the gas is made. The quality of coal is therefore of the utmost importance to the gas manufacturer, and when he is compelled to furnish a gas containing not over 20 grains of sulphur per 100 cu. ft. he must either buy low sulphur coal at a premium or else use expensive methods of gas purification.

Not only have the low sulphur areas of the coal seams been the first to be mined, but in order to meet the requirements of the discriminating trade the miner has had to leave a considerable percentage of the coal unmined, simply because it contained somewhat over one per cent. of sulphur. Gas regulations similar to those in force in Massachusetts which confine the manufacture of gas to these very low sulphur coals are in part responsible for this waste of one of our most valuable national resources. The people of the country are awakening to the existing conditions and before long laws will undoubtedly be passed and enforced which will cause the unwarranted waste of fifty per cent. of our coal supply to cease. The effect of these changed conditions will force the gas manufacturer to use higher sulphur coals whereupon the difficulties now encountered in conforming to the law will be greatly increased unless the limit of sulphur in gas is raised.

Mr. Little shows that if the gas manufacturer were the only one who asked for a low sulphur coal, his requirements might be met but from the limited tonage of low sulphur coal the iron and steel industries necessarily draw part of their supply in addition to the coal derived from property which they already control and operate. There must necessarily exist therefore a competition for low sulphur coal between the steel companies and the gas manufacturers, in which the latter are at a disadvantage, for on account of the larger scale of operation of the steel producers and of the tremendous importance to them of low sulphur coal, they unquestionably have the first call on the supply. In order to comply with restrictions designed to mitigate an evil that has never been proved to exist, the gas companies abet a real one, for it has been thoroughly proved that sulphur in steel rails, bridge members, etc., constitutes a great source of danger and is a real menace to safety and life.

The raising or removing of the sulphur restriction in gas would result in a more economical purchase of gas coal and make it possible to buy coal more on its real merits for gas manufacture than on this one impurity, which in itself is of little consequence. Even if all restrictions were removed it would still be to the interest of the gas manufacturer to buy a comparatively low sulphur coal, because of the expense of taking out the hydrogen sulphide, and the trouble arising from a clinkering coke. The latter is not due to sulphur primarily but due to the higher percentage of iron which is usually present with the sulphur.


# It's a Pipe
## Threading and Cutting Machine



and the BEST one ever designed for the purpose, as it requires very little space. Works Rapidly and Easily by power and can also be operated by hand.

*Write for circular of*

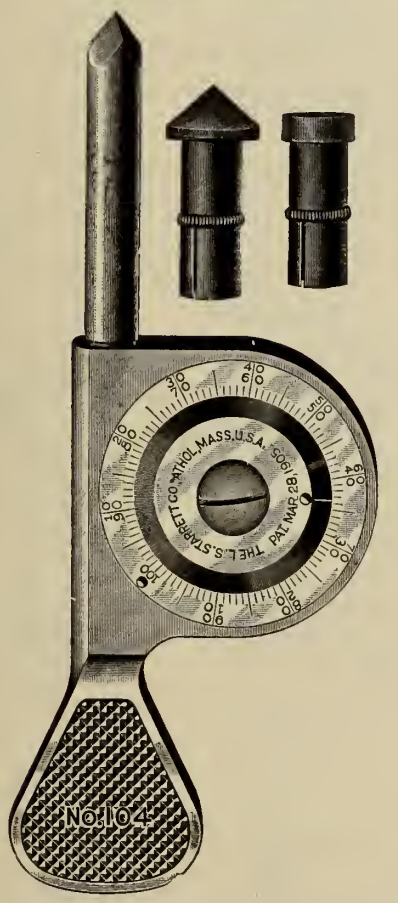
**The Forbes Patent Die Stock**

THE CURTIS & CURTIS CO.
26 Garden St. Bridgeport, Conn.

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.
Start in TO-DAY to earn one of these handy Tools.

**THE POWER HOUSE**
10 Front Street East TORONTO



# Snaps for Quick Sale

## MOTORS AND GENERATORS

| | | | | | | |
|---|---|---|---|---|---|---|
| 1½ | H.P., | 110 | Volt, | (J.&M.) | Motor | (Used). |
| 2 | " | 110 | " | " | " | " |
| 3½ | " | 500 | " | " | " | " |
| 6 | " | 500 | " | " | " | " |
| 12 | " | 250 | " | (C.E.) | " | " |
| 7½ | " | 500 | " | (G.E.) | " | " |
| 15 | " | 500 | " | (U.E.Co.) | " | " |
| 25 | " | 500 | " | (J. & M.) | " | " |
| 150 | " | 500 | " | (U.E.Co.) | Generator | (New). |
| 400 | " | 3 phase | " | " | " | " |

Also our own make of brand new generators and motors (made under Johnson patents) in all sizes, both for A.C. and D.C. circuits, from ¼ to 500 H.P. or larger. The only MULTISPEED motor made in Canada. The only D.C. and A.C. Generators that can remain on SHORT CIRCUIT indefinitely.

**Canadian Electrical and Motor Co.**
Limited
468-474 King Street West, TORONTO
Main 2425

**More Power** for the **Same Money** Or the **Same Power** for **Less Money**

Every boiler plant that wants an increase of efficiency or a reduction in cost of operating needs

# THE TURBO-BLOWER

With its service you can burn any grade of fuel and get full results from your boilers. Its construction embodies the combined principles of a BLOWER, a STEAM JET and a self-contained MOTOR; the latter entirely enclosed and absolutely beyond reach of ashes, dirt or dust.

Drop us a line explaining your present conditions and we will show you how we make good our claims.

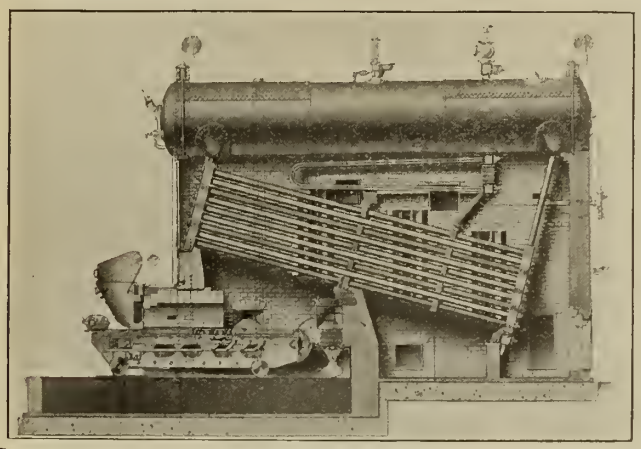
TURBO-BLOWER CO., 30 Church Street NEW YORK, N.Y.

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

**With Furnaces for all Classes of Fuel or Waste Gases**

**HIGHEST ECONOMY, SAFETY, DURABILITY** **OVER 7,000,000 H.P. IN USE**



Babcock & Wilcox Patent Water Tube Boiler, Superheater, and Mechanical Stoker

ALSO

**Steam Superheaters**
**Mechanical Stokers**
**Coal-Handling Machinery**
**Piping, Feed Water Heaters**
**Water Softeners and Purifiers**
**and ELECTRIC CRANES**

Our Book "STEAM" sent on request

**HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL**

**TORONTO OFFICE, TRADERS BANK BUILDING**

# STEAM EQUIPMENT

## HORIZONTAL BOILERS

1 refitted 66"x14'7" contains 106—3" tubes.
1 refitted 60"x17'6" contains 54—4" tubes.
1 refitted 60"x17' contains 46—4" tubes.
1 refitted 56"x14'4" contains 64—3" tubes.
1 refitted 60"x13'6" contains 72—3" tubes.
1 refitted 54"x14' contains 70—3" tubes.
1 refitted 60"x12' contains 70—3" tubes.
1 refitted 50"x14' contains 60—3" tubes.
1 refitted 50"x14' contains 64—3" tubes.
1 refitted 54"x12' contains 64—3" tubes.
1 refitted 56"x12' contains 60—3" tubes.
1 refitted 48"x15' contains 54—3" tubes.
1 refitted 48"x13'6" contains 44—3" tubes.
1 refitted 52"x11' contains 68—3" tubes.
1 refitted 48"x15'6" contains 52—3" tubes.
1 refitted 48"x12' contains 52—3" tubes.
1 refitted 48"x13'6" contains 42—3" tubes.
1 refitted 44"x13'2" contains 48—3" tubes.
1 refitted 44"x11'9" contains 42—3" tubes.
1 refitted 44"x10' contains 48—3" tubes.
1 refitted 40"x13'4" contains 36—3" tubes.
1 refitted 40"x12' contains 32—3" tubes.
1 refitted 38"x15' contains 34—3" tubes.
1 refitted 40"x11'5" contains 40—3" tubes.
1 refitted 38"x10' contains 28—3" tubes.

## FIRE BOX BOILERS

1 refitted 48"x20' contains 52—3" tubes.
1 nearly new 44"x18' contains 46—3" tubes.
1 refitted 36"x13'10" contains 36—3" tubes.
1 refitted 36"x13' contains 44—2½" tubes.
1 refitted 36"x12'11" contains 42—2½" tubes.

## VERTICAL BOILERS

1 refitted 48"x10'6" contains 152—2" tubes.
1 refitted 55"x71" contains 120—2" tubes.
2 new 42"x87" contains 92—2" tubes.
2 new 36"x96" contains 68—2" tubes.
1 new 36"x96" contains 55—2" tubes.
2 new 36"x78" contains 68—2" tubes.
1 refitted 36"x87" contains 78—2" tubes.
1 new 36"x84" contains 55—2" tubes.
1 refitted 40"x65" contains 137—1½" tubes.
1 new 36"x72" contains 55—2" tubes.
1 refitted 30"x72" contains 55—2" tubes.
2 refitted 30"x60" contains 43—2" tubes.
2 new 26"x60" contains 37—2" tubes.
1 new 24"x60" contains 31—2" tubes.
1 new 24"x50" contains 31—2" tubes.
2 refitted 20"x43" contains 19—2" tubes.
6 new 19"x44" contains 13—2" tubes.

## AUTOMATIC ENGINES

1 refitted 12"x30" Ror LH. Corliss.
1 refitted 12"x28" Ror LH. Corliss.
1 refitted 12"x10" Westinghouse Junior.
1 new 10"x15" Jewel.
1 refitted 10"x10" Leonard-Peerless
1 refitted 9½"&14½"x12" tandem.
1 refitted 8"&13"x18" tandem.
1 refitted 9"x24" R.H. Wheelcock.
1 refitted 8½"x24" L.H. Wheelock.
1 rebuilt 7"x10" Leonard-Ball.
1 refitted 6½"x9" Armington & Sims.

## VERTICAL ENGINES

1 refitted 16"x16" slide valve.
2 new 7½"x10" Dutton slide valve.
2 new 7½"x9" Dutton slide valve.
2 new 7½"x8" Dutton slide valve.
1 refitted 6½"x8" Doty slide valve.
1 refitted 6"x8" piston slide valve
2 new 5"x7½" Dutton slide valve.
1 new 4½"x5" Dutton slide valve.
2 new 4"x5" Dutton slide valve.
1 new 2½"x3" Dutton slide valve.

## HORIZONTAL ENGINES

1 refitted 16"x24" L.H. rocking valve.
1 refitted 11¼"x14" L.H. slide valve.
1 new 12"x15" C.C. slide valve.
1 refitted 12"x12" C.C. slide valve.
1 refitted 10¼"x14" C.C. slide valve
1 refitted 10¼"x16" R.H. slide valve.
1 new 10"x15" C.C. slide valve.
1 refitted 8½"x9" R.H. slide valve.
1 refitted 8"x10" L.H. slide valve.
1 refitted 8"x13" R.H. slide valve.
1 refitted 8"x12" R.H. rocking valve.
1 refitted 8"x8" C.C. slide valve.
2 refitted 7"x12" C.C. rocking valve.
1 refitted 6½"x10" L.H. slide valve
1 nearly new 7½"x8" C.C. slide valve.
1 refitted 5"x7" C.C. slide valve.

## MARINE ENGINES

1 new 12"&23"x18" steeple compound.
2 new 7"&14"x10" F. & A. compound.
1 new 9"x12" slide valve.
1 refitted 6"x6" slide valve.
1 refitted 4"x5" slide valve.

***OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST***

# H. W. PETRIE, Ltd., Toronto, Montreal, Vancouver

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Canada Chemical Mfg. Co., London
Hygienic Laboratories, Toronto
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto

## Boiler Feed Pumps.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Wm. B. Pierce Co., Buffalo

## Boilers.

Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Canners' Machinery.

J. C. Wilson & Co., Glenora, Ont.

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Canada Chemical Mfg. Co., London

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
John B. McRae, Ottawa
Walter J. Francis, Montreal.
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenora, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Sight Feed Oil Pump Co., Milwaukee, Wis.

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo, N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co, Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London. Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Peterboro Lubricator Mfg. Co., Peterhor.

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

### Lubricators, Force Feed.

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Sight Feed Oil Pump Co., Milwaukee, Wis

### Maple Cogs.

J. C. Wilson & Co., Glenora, Ont.

### Mechanical Stokers.

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

### Meters, Water and Electric.

Peller & MacKenzie, Montreal

### Mill Machinery.

Allis-Chalmers Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg, Co., Lindsay, Ont
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

### Mining Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

### Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Oilers, Gang.

Sight Feed Oil Pump Co., Milwaukee, Wis

### Oil Filters

Darling Bros., Montreal

### Oil Separators.

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Packing, Metallic.

Rhodes Improved Metallic Packing Co. Montreal

### Panels, Electric

Hill Electric Switch Co., Montreal

### Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pipe Cutting and Threading Machines.

Curtis & Curtis Co., Bridgeport, Conn.

### Pipe Threading Tools.

Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Piping, Steam,

Babcock & Wilcox, Montreal

### Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Polish, Metal,

G. W. Hoffman, Indianapolis

### Power Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

### Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

### Processing Retorts.

J. C. Wilson & Co., Glenora, Ont.

### Pulleys, Iron.

J. C. Wilson & Co., Glenora, Ont.

### Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montrea

### Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros , Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pump Strainers.

Canadian Steam Boiler Equipment Co., Toronto

### Pumps, Air,

Lunkenheimer Co., Cincinnati, Ohio

### Pumps, Oil.

Sight Feed Oil Pump Co., Milwaukee, Wis.

### Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.

Goldie & McCulloch Co., Galt.

### Safety valves.

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

### Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,
J. C. Wilson & Co., Glenora, Ont.

### Shaking and Dumping Grate

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

### Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto

### Smoke Stacks.

Babcock & Wilcox, Montreal

### Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

### Sprocket Wheels.

J. C. Wilson & Co., Glenora, Ont.

### Spur Wheels.

J. C. Wilson & Co., Glenora, Ont.

### Steam Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

### Steam Separator.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto

### Steam Specialties.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

### Switches, Electric

Hill Electric Switch Co., Montreal

### Superheaters, Steam,

Babcock & Wilcox, Montreal

### Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co , Montreal

### Tanks, Blow-off

Darling Bros., Montreal

### Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

### Tests and Inspections.

Bain & Mitchell, Montreal

### Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal

### Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Tubes, Boiler,

Babcock & Wilcox, Montreal

### Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd , Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

### Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

### Unions

Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio

### Vacuum Drying and Impregnating Apparatus.

J. P. Devine Co., Buffalo, N.Y.

### Vacuum Governors.

Canadian Steam Boiler Equipment Co., Toronto

### Vacuum Pans.

J. P. Devine Co., Buffalo, N.Y.

### Vacuum Pumps.

Canadian Steam Boiler Equipment Co., Toronto
J. P. Devine Co., Buffalo, N.Y.

### Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Valve Reseating Machines

Darling Bros., Montreal

### Valves.

Canadian Steam Boiler Equipment Co., Toronto
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Standard Engineering Co., Toronto.

### Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

### Water Purifiers.

Babcock & Wilcox, Montreal

### Water Softeners.

Babcock & Wilcox, Montreal

### Watt Meters.

Gas & Electric Power Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock ..... inside front cover

**B**

Babcock & Wilcox ..... 60
Beaubien, De Gaspe ..... 66
Borden-Canadian Co ..... 14
Brownell Co ..... 3
Butterworth Foundry Co ..... 14

**C**

Canada Chemical Mfg. Co ..... 7
Canada Gas Power & Fuel Co ..... 70
Canada Metal Co ..... 11
Canadian Assn. Stationary Engineers ..... 69
Canadian Electric & Motor Co ..... 59
Canadian Steam Boiler Equipment Co ..... 4
Canadian Tungsten Lamp Co ..... 63
Chaplin-Fulton Mfg. Co ..... 9
Corbet Boiler & Machine Co ..... 67
Curtis & Curtis ..... 58

**D**

Darling Bros ..... 9
Dart Union Co ..... 15
Death & Watson ..... 66
Devine, J. P., Co ..... 63
Diamond Grate Bar Co ..... 5
Dominion Belting Co ..... 13
Dominion Electric Co ..... 72
Dymond Gas and Engine Co ..... 67

**E**

Electrical Maintenance & Repair Co .... inside back cover

**F**

Farmer, John T ..... 66
Featherstonhaugh ..... 66
Francis, Walter J ..... 66

**G**

Galt & Smith ..... 66
Garde, John, & Co ..... 66
Goldie & McCulloch Co ..... 16
Goodhue, J. L., & Co ..... 13
Goold, Shapley & Muir ..... 70

**H**

Hercules Float Works ..... 66
Hill Electric Switch Co ..... 72
Hoffman, G. W ..... 58
Hygienic Laboratories ..... 71

**I**

Ideal Clutch Mfg. Co ..... 10
Ideal Steam Separator & Supply Co ..... 6

**J**

Jenckes Machine Co ..... 3
Johnson, F. M. G ..... 66
Jones & Moore Electric Co ..... 58
Jones Underfeed Stoker Co ..... 69

**K**

Kerr Engine Co ..... 8
Kilmer, Pullen & Burnham ..... inside back cover

**L**

Leonard, E., & Sons ..... 3
Lunkenheimer Co ..... 8

**Mc**

McGhie, W. C ..... 67
McLaren, D. K., Ltd ..... 12
McLeod & Henry Co ..... 11
McRae, J B ..... 66

**M**

Merrill, Edward B ..... 66
Mitchell, C. H. & P. H. ..... 66
Morrison Brass Mfg. Co., Ltd., Jas. ..outside back cover, 66

**P**

Packard Electric Co., Ltd ..... 72
Peiler & MacKenzie ..... 8
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 60
Pierce, W. B ..... 7
Plomo Specialty Mfg. Co ..... 67
Polson Iron Works ..... 2

**R**

Rhodes Improved Metallic Packing Co ..... 15
Robb Engineering Co ..... 15
Robertson, J. M ..... 66
Russel & Gifford ..... 71

**S**

Sadler & Haworth ..... 13
Sammett, M. A ..... 66
Shanly, J. M ..... 66
Sight Feed Oil Pump Co ..... 9
Skaleoff Co ..... 71
Smith, Kerry & Chace ..... 66
Snowdon, S. S ..... 71
Standard Engineering Co ..... 9

**T**

Technical Books ..... 68
Turbo-Blower Co ..... 59
Turner, C. B., & Co ..... 7

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 69
Wilson, J. C., & Co ..... 66

THE

## Emil Passburg System

### Vacuum Drying and Impregnating

Drys and Impregnates electric cables, dynamo and motor armatures, filed and magnet coils, etc. Impregnating compound enters the vacuum chamber without breaking the vacuum, thus eliminating the possibility of the dried coils re-absorbing moisture. The most economical and satisfactory Drying and Impregnating process known to science.

*All sizes and types. Write us for complete catalog*

**J. P. DEVINE CO.**

**BUFFALO, N.Y.**

---

**LUFKIN** **MACHINE DIVIDED RULES**

**ARE STANDARDS OF ACCURACY AND MATERIAL**

**Our catalog tells about their many superior features. It's sent free on request.**

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.

---

# "KOLLOID-WOLFRAM"

(REGISTERED TRADE MARK)

# TUNGSTEN LAMPS

commend themselves as savers of electric current.

The only genuine original metallic filament lamp. Burns any angle on alternating or direct circuits.

**Average Life 1,000 Hours.**

Highest efficiency, lowest voltage. Saves 70% current. Consumption one watt per C.P.

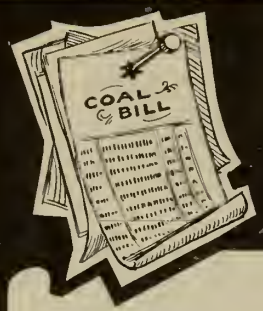
10, 16 C.P.—25 volts.
16, 20, 25, 32, 40, 50, 75, 100 C.P.—110, 115, 120 volts.
32, 50, 75, 100 C.P.—225, 250 volts.

Edison Base. *Write for Prices.*

## The Canadian Tungsten Lamp Co., LIMITED

*Operating* **The Ontario Lantern & Lamp Co., Limited**

**Hamilton, - Ontario**




# BOILER SCALE IS A LUXURY!

OUR METHOD:—(We carry no compounds in stock). Express us a gallon of your boiler feed water, and we will prepare an analysis of same for you free of charge. We will then be in a position to make a compound specially prepared to meet the conditions at your plant, if you so desire, on which we will be pleased to give the following guarantee:

OUR GUARANTEE—(Every barrel of our compound is guaranteed.)

WE GUARANTEE—Red Star Boiler Compound to gradually remove old scale, eradicate grease (when returns are used), and prevent formation of new scale in any steam boiler in which it is used according to our directions.

WE GUARANTEE—Red Star Boiler Compound will not injure the iron, brasses, packing, or any other part of any steam plant. It will arrest pitting and prevent corrosion.

WE GUARANTEE—Red Star Boiler Compound will not contaminate live steam, so that same may be safely used for cooking purposes, for lard rendering, for distilling liquors, for brewery use, in dyeing establishments; in fact, wherever live steam is used direct from boilers.

**A FEEDER FREE** Wherever our Red Star Compound is used we will loan one of our Perfection Automatic Back Pressure Boiler Compound Feeders ABSOLUTELY FREE.

*Investigate our proposition by writing for illustrated booklet. It will interest you.*

## HYGIENIC LABORATORIES, LIMITED

11 COLBORNE ST., TORONTO, CANADA

# RED STAR COMPOUND KILLS SCALE!

THE POWER HOUSE

## VENETIAN GRATES

STEAM BLOWN

# Cheap Power

WITH

# Cheap Steam

Your boilers fired with cheap grades of fuel, with a saving of 15% to 60% in your fuel bills.

SMOKELESS COMBUSTION

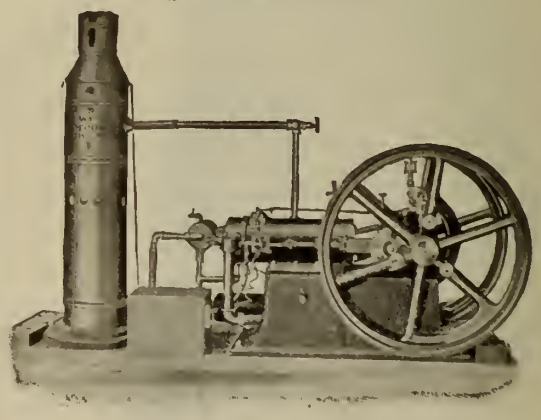
WRITE US FOR PRICES AND PARTICULARS

## The Canada Gas Power & Fuel Co.

68 St. James St. West, Montreal

# GAS and GASOLINE ENGINES

1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

## Goold, Shapley & Muir Co.

Limited

BRANTFORD - CANADA

# Potato Scale Powder Boiler Cleanser

***The Fuel Saver***

NO EFFECT ON THE BOILER PIPES SHELL OR CONNECTIONS

KEEPS YOUR BOILERS FROM FOAMING

We can furnish you with hundreds of testimonials from some of the best plants in the world.

**Guaranteed to give Satisfaction.**

Sole Agent for America:

Mail us a sample of your water and we will prove to you that we keep your boiler clean without doing it any damrge, besides save you a lot of money in fuel.

## C. C. SNOWDON

Wholesale Oil Merchant — CALGARY, Alta.

P.O. Box 1384 Phone 417
Address all Correspondence to Calgary

Branch Storage at New York — Branch Storage at Montreal



# THINK

## Are you short of POWER?

"WING" System of Forced Draft developed 118 HP. on a 60 HP. B. & W. Boiler at McGill University.

*MADE BY*

## RUSSEL & GIFFORD

Montreal - 505 Power Bldg.

Toronto 464 McKinnon Bldg.

Write for Circular.



# One Moment Please

## Are You Obtaining the best Results From Your Boiler?

¶ You can get 100 cents worth of steam for every dollar's worth of fuel, providing your boiler is clean and in good condition.

¶ "SKALEOFF" will positively remove and prevent scale and will preserve the boiler and packing.

¶ "SKALEOFF" can be kept in the boiler as long as you may require to keep the boiler closed. There is no need of changing the water except when cleaning out the boilers.

¶ "SKALEOFF" does not contain any strong corroding ingredients, such as acid-salts, caustics, slacked lime, soda ash, etc.

¶ "SKALEOFF" positively will not eat packing or scratch the varions engine or pump rods, it will not ruin valves or joints, it will not cause a leaky boiler either at a seam, joint or rivet.

¶ We will be pleased to furnish, free of charge, enough "SKALEOFF" to make a thorough test.

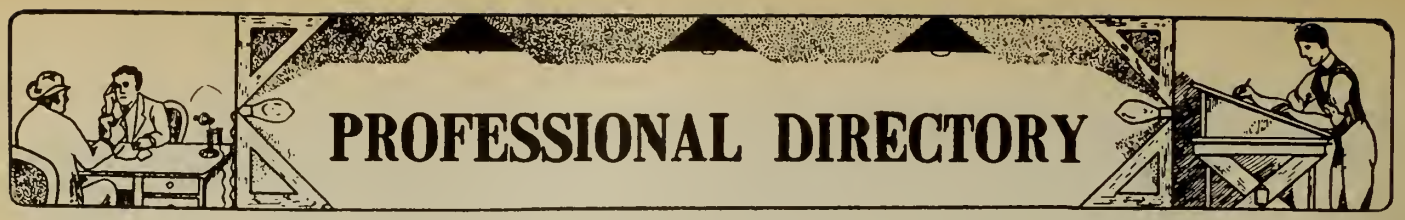
¶ There is satisfaction in every barrel and our guarantee goes with every barrel you get.

¶ *Send for particulars and have a free test made in your own boilers under your own conditions. Don't take our "say so" let us SHOW you.*

## The "SKALEOFF" CO.

65 Shannon Street

**Montreal**



# PROFESSIONAL DIRECTORY


**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

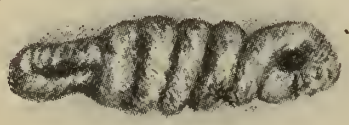
**M. A SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**SMITH, KERRY & CHACE**
ENGINEERS
Hydraulic, Steam, Electric, Railway, Municipal, Industrial
W.U. Code used. Cable Address "Smitheo."
TORONTO — Cecil B. Smith
WINNIPEG — J. G. G. Kerry
CALGARY — W. G. Chace

**JOHN GARDE & CO.**
142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge"
Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

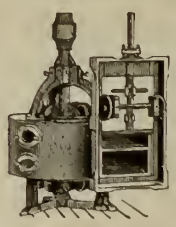
**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 2736

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street Toronto

**HERCULES Seamless Copper FLOATS**
**Are Absolutely Reliable**

We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request.
**Hercules Float Works**
P.O. Box 396. Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest efficiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.

## PLOMO BELT DRESSING

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical--a spoonful will dress an 8 inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places. Permits belts to be run slack without slipping--slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

*Write for Booklet and 25 lb. trial package.*

**The Plomo Specialty Mfg. Co.**

CLEVELAND, O.

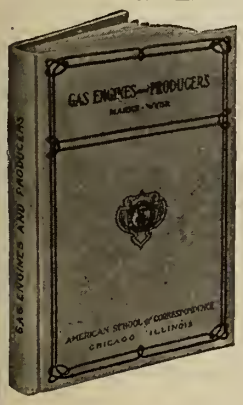


## Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over in the Province of Ontario must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act.

W. C. McGHIE,
Chairman of Board






## The Gas Engine in Principle and Practice

*By A. H. Goldingham*

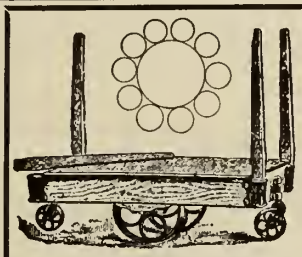
***Price $1.50, Postpaid***
***195 Pages, 107 Illustrations***

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

***Technical Book Department***

**The MacLean Publishing Co., Ltd.,** 10 Front St. East, Toronto





Roller Bearing Factory Truck

Roller Bearing Factory Trucks

The only ones made in Canada

Dry Kilns Installed

Roller Bearing Dry Kiln Trucks
Roller Bearing Transfer Trucks
Roller Bearing Lumber Trucks

MUNICIPAL STEEL BRIDGES Specifications Solicited . .

We make any kind of truck to specifications. Heavy duty truck a specialty. Write for prices to

Corbet Foundry & Machine Co., Owen Sound



# The Dymond Gas & Engine Co.

LIMITED

131 Queen Street East, TORONTO

MAKERS OF

# GAS PRODUCERS PRESSURE AND SUCTION

FOR ANTHRACITE COAL

Pressure Bituminous Plants for Large Instalations

# HIGHEST THERMAL EFFICIENCY

AGENTS FOR

CROSSLEY BROS. GAS ENGINES—Vertical and Horizontal, all sizes and types
WILLIAMS & ROBINSON STEAM TURBINES

If your present power is not satisfactory, advise us and we will help you out and guarantee results

# Which Book Do You Prefer?

Below is a list of books, every one of which is extremely interesting and helpful to Engineers, and you may secure any one of them, or all of them

**ABSOLUTELY FREE OF COST.**

Here is our proposition to you :

As a subscriber to The Power House, you know it is a publication that you can honestly recommend to Engineers. Well, by recommending The Power House to your engineering acquaintances and taking their paid-up subscriptions you can have any of the following books on this basis :—

### For one new paid-up subscription a choice of these two books :

**STEAM BOILERS.** By William S. Newell, S. B., with Bath Iron Works, formerly Instructor Massachusetts Institute of Technology, and Carl S. Dow, S. B., American Society Mechanical Engineers. 160 pp., 140 illus. Cloth binding. A practical treatise on the materials and approved methods of construction of steam boilers, with complete instruction in the mechanical details of the various commercial types of stationary boilers, such as the vertical, horizontal, water-tube, fire-tube, etc. Value.....$1 00.

**BOILER ACCESSORIES.** By Walter S. Leland, S. B. Assistant Professor of Naval Architecture, Mass. Institute of Technology, American Society Naval Architects and Marine Engineers. 144 pp. 80 illus. Cloth binding. A treatise giving complete descriptions of the various accessories of the boiler room and engine room essential to economical operation, such as evaporators, pumps, feed-water heaters, injectors, mechanical stokers, etc., with practical instruction in their use. Value....$1.00.

### For two new paid-up subscriptions a choice of these two books

**A POCKET BOOK FOR BOILERMAKERS AND STEAM USERS.** By Maurice John Sexton, comprising a variety of useful information for employees, Government inspectors, Board of Trade surveyors, engineers in charge of works and ships, foremen and every user of steam power. Leather Binding. Value.....$2.00.

**STEAM BOILERS. Their Management and Working on Land and Sea.** By James Peattie. 230 pages, 35 illustrations, cloth binding. Covers the whole art of keeping steam boilers in fine working order under all sorts of conditions. This is a splendid book. Value.....$2.00.

### For three new paid-up subscriptions a choice of these two books

**KLEINHANS. Boiler Construction.** The only book showing how locomotive boilers are built in modern shops. Shows all types of boilers used; gives details of construction ; practical facts, such as life of riveting punches and dies, work done per day, allowance for bending and flanging sheets and other data that means dollars to any railroad man. 421 pages. 334 illustrations. Six folding plates. Value.....$3.00.

**BUCHETTI. Engine Tests and Boiler Efficiencies.** This work fully describes and illustrates the method of testing the power of steam engines, turbine and explosive motors, the properties of steam and the evaporative power of fuels. Combustion of fuel and chimney draft; with formulas explained or practically computed. 255 pages. 179 illustrations. Value.....$3.00.

Don't miss this opportunity to secure valuable technical books free of cost. The subscription price to The Power House for one year is one dollar, and **you know** that it is splendid value for the money.

## THE POWER HOUSE, 10 Front St. East, Toronto

**N.B.—If you do not get these subscriptions, any of these books may be secured from us at the price mentioned after each book.**

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

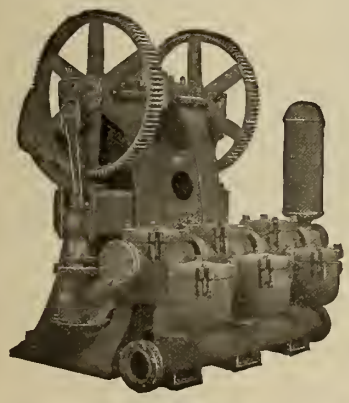
## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA





## On Account

of their Extremely Low Cost of Operation and the Small Amount of Attention Required

# Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**
Coristine Bldg., Montreal
Phone Main 1054
*Works - - - - - Seneca Falls, N.Y.*



# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

# When Buyers Forget to Forget

when competition ceases to compete ; when every actual and prospective customer has been convinced that your product is the best of its kind and nothing better can be produced, then, and only then, will it be safe to

## Get Along Without Advertising

Just so long as old buyers die and new ones take their places ; just so long as there is competition to coax your customers from you ; just so long as there is a possibility that somebody else will produce a better product, just so long will it be important, absolutely necessary, to carry on the work of educating and reminding your own and your competitors' customers as to your goods.

And just so long as the buyers and prospective buyers in a given trade or profession subscribe to the publications representing that trade or profession, just so long will there be no better way to reach and impress them with your business story, than through the technical and trade publications which they look to and depend upon for information which enables them to compete successfully along their own lines.—SELLING MAGAZINE.

Manufacturers of power equipment and supplies should bear in mind that this journal has behind it a subscription organization unequalled in Canada. For the past few weeks this organization has sent in over one hundred new subscribers per week. Our records are open for your inspection.

In considering your advertising campaign, is it not good business to place your appropriation with a medium through which you can reach the largest number of buyers in your field ?

We will be glad to quote you rates.

# THE POWER HOUSE

10 FRONT ST. EAST, TORONTO

CHICAGO
933 Monadnock Block

NEW YORK
1109-1111 Lawyers' Title, Insurance and Trust Bldg.

EUROPEAN OFFICE
88 Fleet Street, London, E.C

MONTREAL
Eastern Townships Bank Bldg.

WINNIPEG
511 Union Bank Building

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five years.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1¼" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### Machinery Wanted

Boiler wanted, 40 h.p. horizontal tube. Must be in first class condition. State full particulars. Imperial Extract Co., Toronto. (6)

D. Maxwell & Sons, St. Mary's, Ont., want Second-hand Air Compressor in good condition. Belt driven, with capacity of about 100 cubic feet free air per minute.

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

One Second-hand Slide Valve Engine, 14 x 18.
One Second-hand Slide Valve Engine, 10 x 15.
One Second-hand Slide Valve Engine, 12 x 16.
New Return Tubular Boilers, 60 x 14 and 72 x 18.
Second-hand Return Tubular Boilers, 36 x 10, 44 x 12, 48 x 12.
OWEN SOUND IRON WORKS, Limited, Owen Sound.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

Transmission Machinery—Write us for prices on shafting, hangers, pulleys, etc.; will promptly figure on any specifications submitted.

Flour Mill Machinery.

The Brown Automatic Engine.

Boilers.

The STRATFORD MILL BUILDING CO., Ltd., Stratford, Ont.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

A 3 h.p. 2 phase 110 volt 66 cycle Canadian General Electric Motor, in good shape—a bargain. Also a 5 h.p. and a 15 h.p. Motor, and transformers in stock.

NORTHERN ELECTRIC SUPPLY CO.,
(5) Orillia, Ont.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory Mayor.

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBON TYPE PORTABLE BOILERS—7 each, 60 h.p.

HEINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

BOILERS—Any size or style required; smokestacks built to order; also steel tanks, steel riveted pipe for flues, etc.; write for prices. Marsh & Henthorn, Belleville, Ont.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12 x 12 M'Ewen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumps, second hand. Waterous Engine Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

## SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

## BOY WANTED

ANY BOY in every town and village in Canada can earn many dollars by selling our publications among his neighbors and relatives and business men.

**YOU** can begin at once. No money needed to start. We will provide you with capital. A watch to the boy who does good work, as special prize.

Write at once to

**THE MACLEAN PUBLISHING CO.**
10 Front St. E., TORONTO

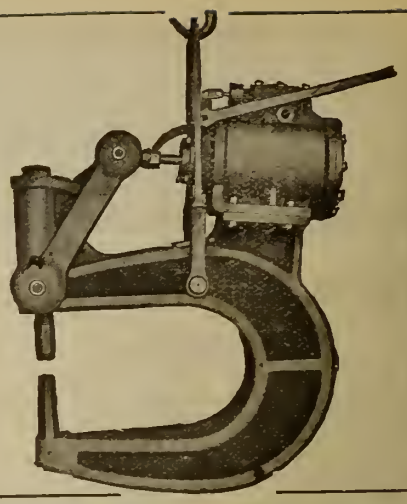
# Every user of Riveting Machines

will be interested in the following unequalled record of

Gauge Tests with "Allen Riveters"

| Air Pressure | Tonnage | Spring in Frame |
|---|---|---|
| 60 lbs. | 53 | 1-4″ |
| 65 | 59 | 1-4″ |
| 70 | 60 | 5-16″ |
| 75 | 62 | 5-16″ |
| 80 | 66 | 5-16″ |
| 90 | 72 | 5-16″ |
| 100 | 80 | 3-8″ |

Special Riveters designed to meet all requirements.



Agents: Canadian Rand Drill Co., Montreal, Que.

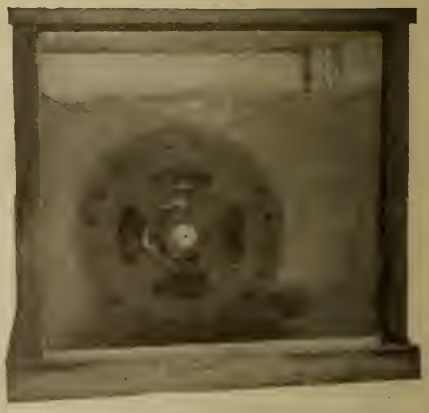
JOHN F. ALLEN, 370 Gerard Ave., NEW YORK, U.S.A.

[Established 1872] LIEBERS AND W. U. CODES. "RIVETERS."

# THE WATER TEST

Packard

## Type "D" Motor



Reproduction from an actual photograph, showing the "Water Test" as applied to a Packard Type "D" Motor.

shown in the picture, proves one of the many points about the PACKARD Type "D" Motors, that combines to make them peculiarly adaptable for severe operating conditions.

The test consisted of a submersion of the motor in a tank. Connection being made to the circuit, the motor was allowed to run—completely under water – for several hours at a time—and, after repeated tests, the insulation was found to be in no-wise affected.

Could you ask better proof of the **ruggedness of design** and **careful construction** of the motor; or of the success of our Vacuum process of insulation?

## The Packard Electric Co., Limited

Head Office and Works
St. Catharines, Ont.

Branch Offices
Montreal and Winnipeg

# SWITCH-BOARDS

**Avail yourself of our**

**Experience and Facilities**

**in switch-board construction**

The Hill Electric Switch and Mfg. Co.

1561 St. Lawrence Street, - Montreal

# WATER POWER

**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, Canals, Hydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**

**TECHNICAL BOOK DEPARTMENT**

**10 Front St East - - Toronto**

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419

# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

# A Guarantee of Quality !

A definite positive guarantee goes with every steam specialty bearing the **J.M.T.** trade-mark, and we make it good enough to put our name on. When you order valves, stop-cocks, injectors, and kindred lines, insist on the best.

Aside from new improvements our goods represent high-class quality and workmanship, with nothing in any sense inferior ever allowed to get past the watchers on guard. The

## J. M. T. Trade Mark

## or the name "MORRISON"

on brass specialties of every sort is equal to the Sterling Stamp on Silver.

Nothing we can say so fully endorses that fact as the growing demand for our goods throughout Canada.

**Your application for anything in our line is solicited. Our aim will be to satisfy you to a little better extent than you expect.**

## The James Morrison Brass Mfg. Co., Limited

**93-97 Adelaide St. West, TORONTO**

REPORT OF C. A. S. E. CONVENTION

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C.

Vol. II. Publication Office, Toronto—August, 1909 No. 8

OUR CATALOG IS FREE FOR THE ASKING. SEND FOR IT TO-DAY.

## The Engineers' Road to Success!

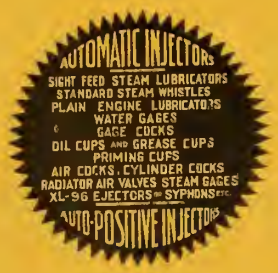
If you are held responsible for results by your employer, insist on his providing you with reliable goods.

Remember that the sound judgment of the

ENGINEER




PLUS THE PENBERTHY LINE




make the best combination for the Engine Room.

**Penberthy Brasses are made for those who want something better than the ordinary cheap and imitation stuff—made for those who pride themselves on equipping their Power Plant with**

**Reputable and Reliable Brasses**

**Specify and insist on**

PENBERTHY

**"They Always Work"**

MANUFACTURED BY

**Penberthy Injector Co.**
LIMITED

WINDSOR, - ONT.

# POWER PLANT EQUIPMENT

***ENGINES*** ***PUMPS***

***BOILERS*** ***CONDENSERS***

***FEED-WATER HEATERS***

***WATER-TUBE BOILERS***

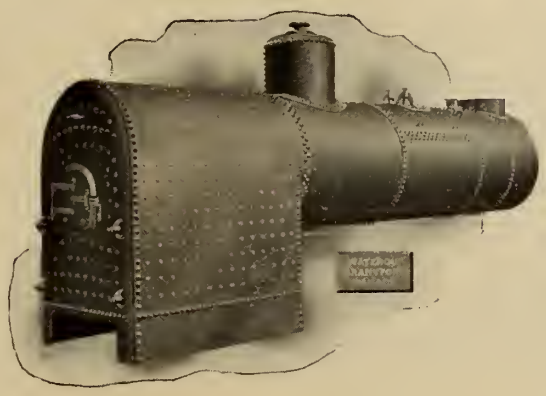
IN STANDARD UNITS OF 100 H.P. AND UPWARDS—SEND FOR BULLETIN 105

## *THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO.*

*LIMITED*

***Sales Offices :*** *MONTREAL, TORONTO, COBALT, WINNIPEG, CALGARY, VANCOUVER*

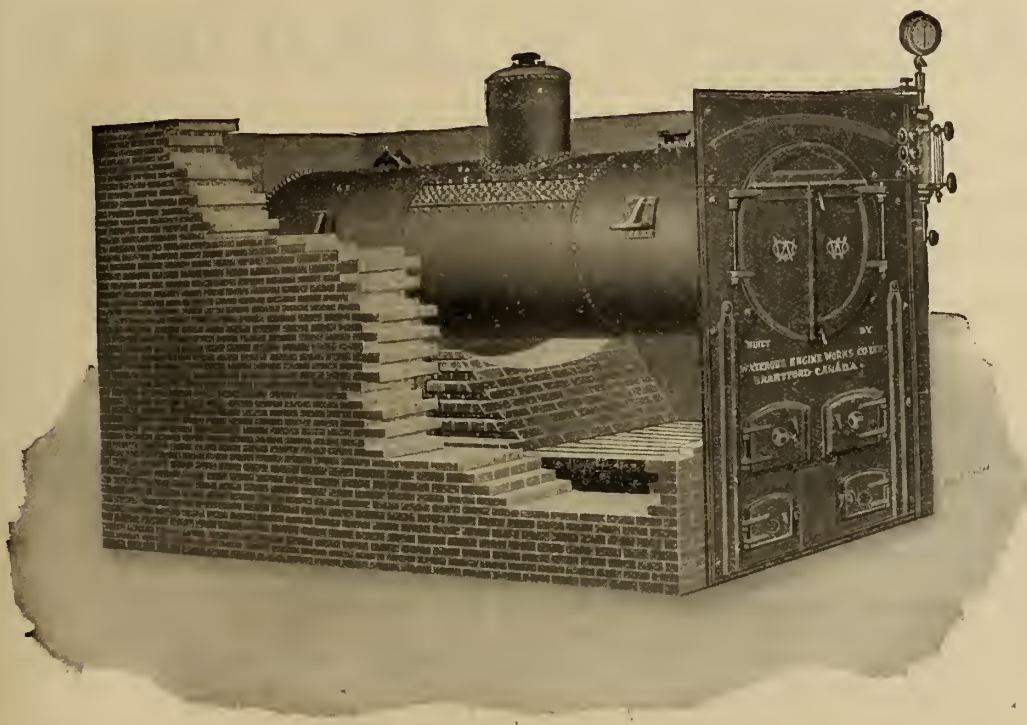
# POWER PLANTS



**Locomotive Boilers**

Built under the British Columbia Boiler Inspection Laws.

10 H. P. to 150 H. P.



**Standard Tubular Stationary Boilers**

The cut represents this style of boiler with ordinary full front setting. Half front and different styles of oven settings can be furnished if desired.

These boilers are built for various pressures and from 10 to 200 horsepower.

We manufacture: Boilers, all types; Stationary, Marine, Automatic, Simple and Compound Engines; Steam Plant Accessories.

**Write for Bulletin and Prices**

## The Waterous Engine Works Co., Limited

**BRANTFORD, - CANADA**

**Western Branch: Winnipeg, Man.** **B.C. Agent: H. B. Gilmour, Vancouver**

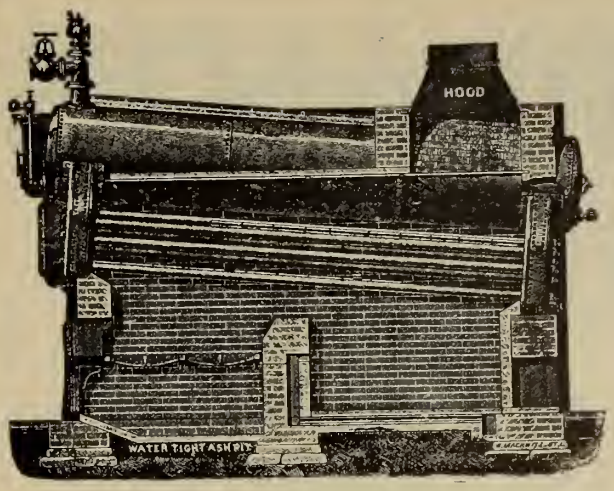



Fig. 1.—Heine Boiler and Setting

# To the man who needs a Power Plant

The great argument in favor of steam power against all other forms of motive power is its *absolute reliability*. Given the *best boiler* and a reliable engine, steam power will never fail. That is why the most extensive power plants in the world are equipped with

# Heine Safety Boilers

They represent steam power at its best. They are the most modern in design, embodying improvements that are found on no other boilers—notably in the matter of scientific fuel combustion and unimpeded water circulation. They are very staunchly built from the best materials, every part and boiler as a whole being severely tested before shipment. They are absolutely safe and can be relied upon under the most exacting conditions.

**As a boiler purchaser—actual or prospective—an examination of our illustrated literature will interest you. It fully describes the Heine Boiler in every detail. Write for it to-day.**

## Polson Iron Works

**LIMITED**

## Toronto - Canada

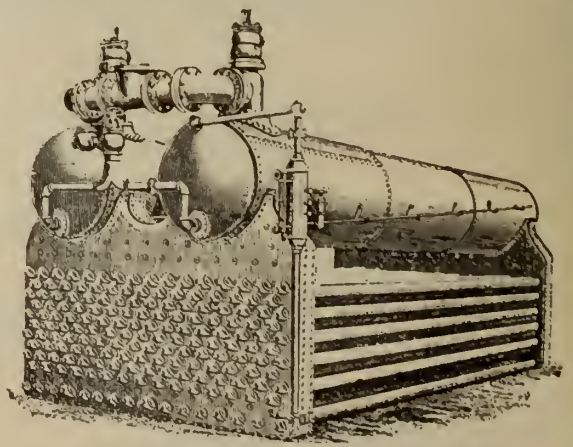


Fig. 2.—The Heine Boiler Without Brick Setting

# BOILERS

In All Sizes

## A Notable Achievement in Tubular Boiler Construction

Our Horizontal Tubular Boiler, the result of thirty years' experience, has three notable points of superiority :

*1st.—It can be operated at high pressure with entire safety.*
*2nd.—It is the most economical in point of fuel consumption.*
*3rd.—It is the easiest to clean, because its tubes never become encrusted.*

**Ask for our Boiler Catalog**

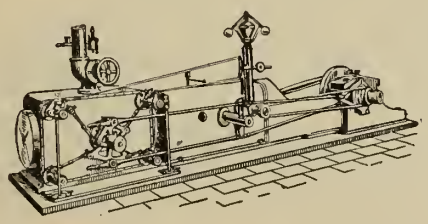
## The Jenckes Machine Company, Limited

**Sherbrooke - Montreal - St. Catharines - Cobalt - Vancouver**

**Works: Sherbrooke, Quebec. - St. Catharines, Ontario**

## ENGINES—

Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper



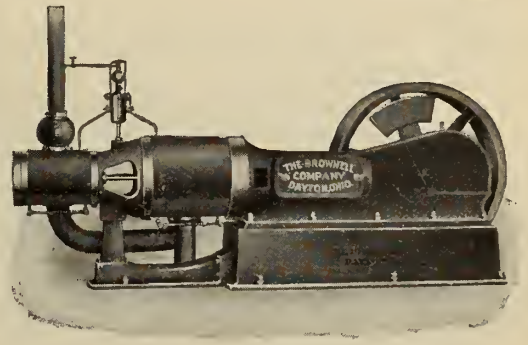
## BOILERS—

Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

LONDON, - ONT.




## The Brownell Company

**Dayton, - Ohio**

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

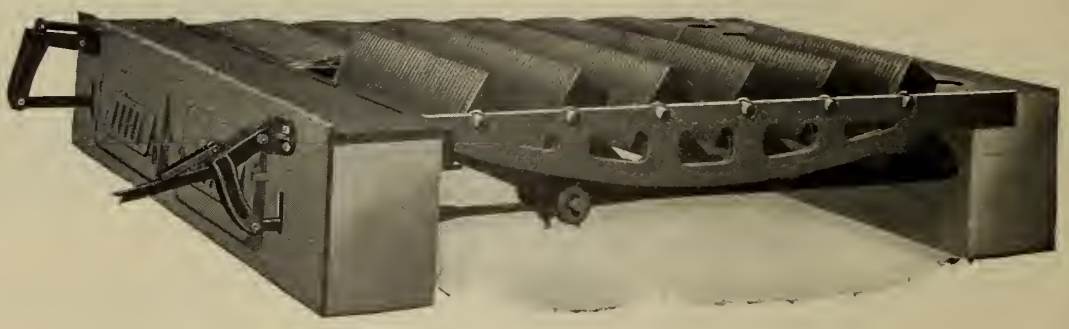
Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# NEW MODEL
# DIAMOND SHAKING AND DUMPING
# ——GRATE BAR——

*By using Diamond Grates you increase your power from 5 to 20%*



*The Diamond Grate is applicable to any type of boiler and to units of any size.*

CANADIAN PATENT 118,778

## THE DIAMOND GRATE

## Has no Equal as to Simplicity and Durability

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal.

TORONTO, Aug. 5th, 1909.

THE DIAMOND GRATE BAR CO.,
119 St. James Chambers, Toronto.

Gentlemen:—The Grate Bars are all you claim for them. The two (2) sets you put in for the Toronto General Hospital are giving perfect satisfaction. They are the most economical bar I have had anything to do with. They are simply perfect. We have had no trouble in burning half and half soft and hard coal screenings, which we could not do before we adopted The Diamond Grate Bar. I can highly recommend the Bar.

With best wishes for your success, I remain, yours truly,

A. E. BENNETT,
Engineer Toronto General Hospital,
Toronto, Ont.

**We make a Specially Heavy Bar for Steamboat and Malleable Annealing Ovens.**

***Boiler Setting and Repairs a Specialty***

***Boiler Tubes, Either Welded or New, at Lowest Price***

*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

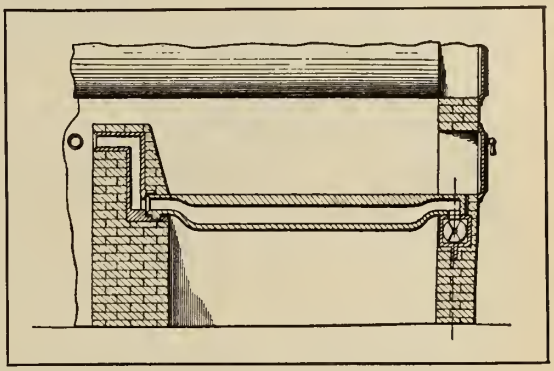
A POST CARD OR PERSONAL INQUIRY WILL BRING A PROMPT REPLY

# The DIAMOND GRATE BAR Company

Head Office and Factory, Berlin, Ont.

Branch Office, 119 St. James' Chambers, Toronto. Tel. M 1342

# Fleming Grate Bars



An examination of this cut will give some idea of the scientific principle upon which Fleming Grate Bars are constructed. The natural draft entering the **AIR COMBUSTION CHAMBER** causes a continuous passage of air through the grate bars, over the bridge wall and into the combustion chamber, where, now heated to a temperature of 600° F., it unites with the unused carbon, causing a further combustion and a consequent increase in heat units. The never-ceasing current of air, passing through the bars, keeps them comparatively cool, thus preventing the adherence of clinkers as well as insuring them a life which is practically perpetual. In addition to the economy in fuel consumption there will be a proportionate decrease in the labor of cleaning, in the expense of renewing grates—to say nothing of the decrease in smoke.

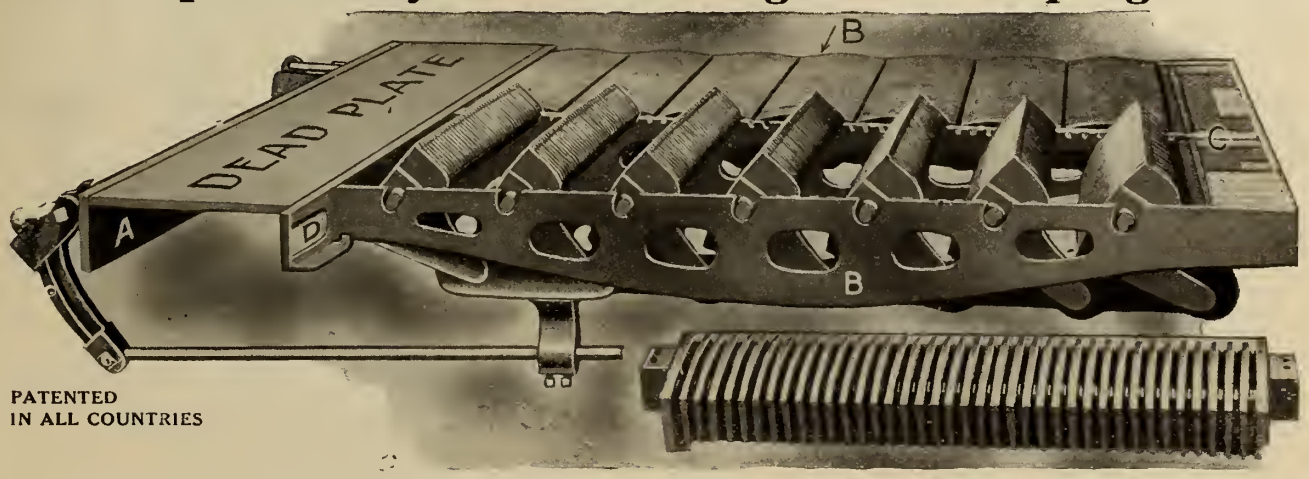
**It means** that with Fleming Grate Bars under your boiler you save from TEN to TWENTY DOLLARS on every hundred dollars worth of fuel you buy.

WRITE FOR BOOKLET.

**BUTTERWORTH FOUNDRY, LIMITED**

53 QUEEN STREET, - OTTAWA, - ONTARIO

# The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES

We have recently improved the Cyclone Grate, adding three most important features to it, which increases its fuel-saving qualities and the life of the bar, also making it shake more easily.

**This letter was recently received by our agent in New Brunswick.**

G. McA. Blizard, Esq., Canada Permanent Chambers, City. St. John, N. B. May 1st. 1909

Dear Sir:—In reference to your enquiry, beg to state we have had the Cyclone shaking and dumping grate bars in use at our Water St. foundry for the past eighteen months.

We consider it one of the best grates of its kind on the market, and if we were installing any more boilers, we would certainly use these grate bars, if they cost three times the money they do, as we consider we have saved double the price of the bars in the last winter. Yours very truly, T. McAVITY & SONS, LIMITED

C.A.A.

***Write for Circular and Full Particulars***

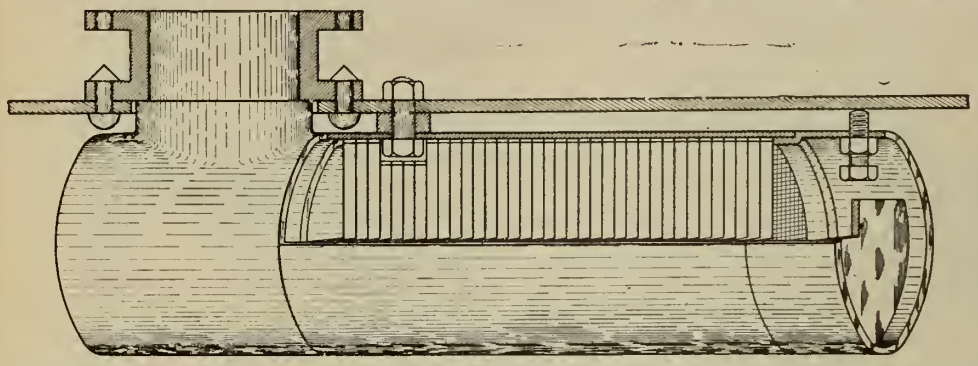
**Canadian Steam Boiler Equipment Company, Limited**

36 and 38 Lombard Street : : : : : : : : : : Toronto

# Wet Steam is Dangerous and Expensive!

That's why most engineers recommend some kind of a steam separator. We can prove to every practical engineer and power user that the one best separator is the

# IDEAL INTERNAL STEAM SEPARATOR



This modern boiler appliance consists of a mechanical casing containing spacing rings, diaphragms, screens and perforated or corrugated plates as conditions call for, placed inside the boiler and requiring no attention. It delivers dry steam at the boiler outlet. An immediate saving is noticed in Time, Fuel, Oil, Packing and Repairs as soon as an Ideal Separator is installed in a boiler. The saving is a permanent one. In addition to the saving it effects, the Ideal Internal Steam Separator eliminates all danger of cylinder heads blowing out or other damage to the engine—or the engineer.

WRITE FOR OUR FREE DESCRIPTIVE BOOKLET

## Ideal Steam Separator and Supply Co.

75 Adelaide Street East, Toronto, Ontario

We also manufacture Potter Separators, Whaley Automatic Smoke Preventers, and Leonhardt Gauge Glass Protectors.

Selling Agents for Wm. W. Nugent & Co., Chicago, Lubricating Devices; Harris Smokeless Furnace Co., Nashville, Tenn.; Watson & McDaniel Co., Philadelphia, Steam Traps and other steam specialties.

WRITE FOR CATALOGUES

IF YOU WANT SATISFACTION WITH
UNIONS AND FLANGES

# GET THE DART

They Are in a Class by Themselves--Nothing Equal

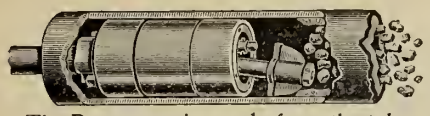
THEY WILL NOT LEAK
REQUIRE NO ATTENTION
AND ARE ALWAYS SERVICEABLE

Use Them and be Convinced

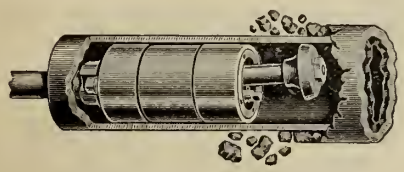
WE GUARANTEE EACH ONE--LOOK FOR THE NAME

# DART UNION CO., Limited

Toronto Works 93-97 Niagara St.



The Dean removing scale from the tube of a Water Tube Boiler.



The Dean removing scale from the tube of a Return Tubular Boiler.

# Scale Removal Made Easy.

Cleaning a boiler of scale is the hardest, nastiest job an engineer has to do. It is usually done on Sundays or Holidays, when other people are at rest or play.

## The Dean Boiler Tube Cleaner

makes the job easy. It cleans 10 to 30 tubes an hour. The same cleaner with a change of vibrators or hammers will clean both water tube and fire tube boilers. The DEAN does its work by vibration—that means thoroughness of work.

Even if you are only remotely interested in the subject of boiler scale, write for booklet No. 130.

**THE WM. B. PIERCE CO., - 330 Washington Street,**
BUFFALO, N.Y.

Every Manufacturer using a steam boiler should know that TRI-SODIUM PHOSPHATE is the only chemical which will absolutely prevent Scale from forming in steam boilers

(Trade Mark) **B-O-S-A-L-T** (Trade Mark)

IS THE GUARANTEED BOILER CLEANER

Manufactured by

THE CANADA CHEMICAL MANUFACTURING COMPANY, Limited
Executive Offices and Chemical Works: London — Warehouses: Toronto and Montreal

# 660
# POUNDS

of condensation per hour can trickle away through a ¼ inch free opening under 10 pounds pressure.

## NEARLY 2,000,000 POUNDS A YEAR

## Use BUNDY Traps

and reduce cost of production.

## RUSSEL & GIFFORD

505 Power Bldg. MONTREAL — *WRITE FOR CATALOGUE* — 404 McKinnon Bldg. TORONTO

Chateauguay Basin Manoir.

26 December 1908.

American Radiator Co.,
Sir,

Permit me to write to you a few words whatsoever I am unknown to you. deign to excuse me, I come with you to have speech of Bundy traps of steam and others, as many people have complained not giving a good satisfaction and as you know many lay aside their returns.

But having one in my service here, I study them (No. 102 Bundy) I find him the true secret and she gives the best service that no one can ask for better, with this you have the best trap in the world and it is for this that I make it my duty to let you know I hope to render a good service to your Company if this should interest you kindly write me an answer.

I remain Sir,
Yours in all devotion,
(Signed) M. Vincent.

P.S. Please give this letter to the manager of the Company.

Maximilien Vincent,
Chateauguay Basin,
Chateauguay County,
Province of Quebec,
Canada.

# Our Business Is To cut out trouble
# To reduce waste
# To give increased efficiency

# Our Business Is growing because we deliver the goods that do the work

**Mason** Reducing Valves, Pump Pressure Regulators, Damper Regulators, Pump Speed Governors, Balanced Valves.

**(Genuine) Ashton** Pop Valves, Pressure and Vacuum Gauges (both indicating and recording), Relief Valves, Alarm Gauges.

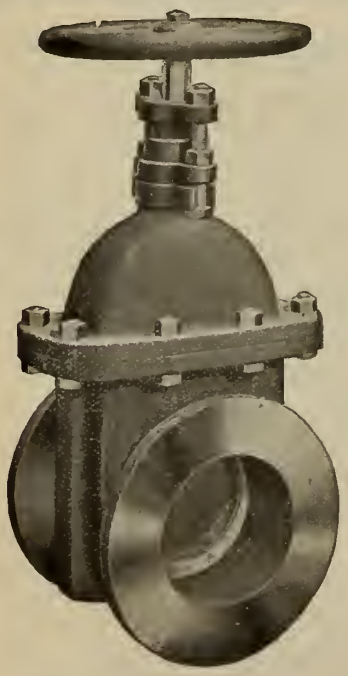
**Reilly** Multicoil Feed Water Heaters, Surface Condensers and Evaporators. The most compact and highly efficient. The lowest is first cost.

**Bundy** Steam Traps, Steam and Oil Separators. The best steam trap made and the most efficient for every service.

These lines appeal to the best judgment of every engineer who takes the trouble to investigate their merits. We represent the manufacturers and are responsible for the reputation of the goods we sell. Our specialty is the economical solution of all problems relating to pressure regulation, and the handling of hot water and returning water direct to the boilers irrespective of temperature or pressure. We have expert engineering service at our disposal.

***ENGINEERS CONFER A FAVOR ON US BY ASKING FOR CATALOGUES AND INFORMATION***

## Peiler & MacKenzie - - - 52 St. James St., Montreal



## *KERR GATE VALVES*

*are to be found in all well equipped steam plants in Canada.*

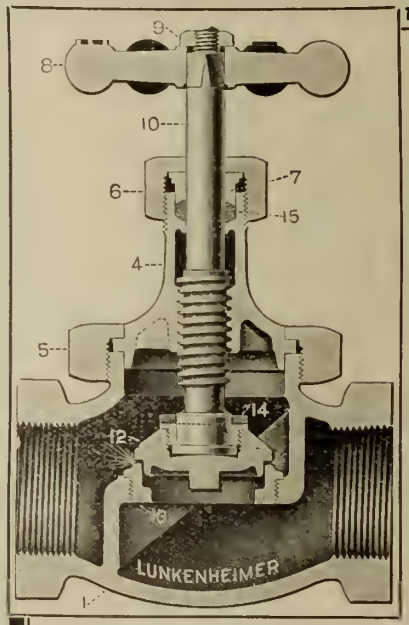
*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

***The Kerr Engine Co., Limited***

***Valve Manufacturers***

***Walkerville, - Ontario***




The SEAT in this valve is SELF-CLEANSING, both DISC and SEAT are RENEWABLE, but can also be REGROUND These Features make the

**LUNKENHEIMER "RENEWO" VALVE**

practically indestructible, and outlast the life of the pipe. The seat is made of a HARD, CLOSE-GRAINED NICKEL and is very durable. All other parts are made of the highest grade of bronze composition.

WRITE FOR CATALOG

"Most supply houses sell them, yours can; if they dont or wont, tell us."

## The LUNKENHEIMER CO.

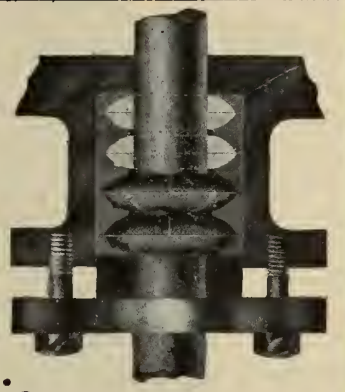
LARGEST MANUFACTURERS OF HIGH-GRADE ENGINEERING SPECIALTIES IN THE WORLD

General Offices and Works, CINCINNATI, Ohio, U.S.A.

BRANCHES { New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E., 35 Great Dover St.

36

THE Packing That Stays Packed



is

**The Rhodes Improved Metallic Packing**

For EVERY service of rod packing and ESPECIALLY ADAPTED FOR AMMONIA.

GUARANTEED!!

Write for Prices and list of Happy Users.

AGENTS WANTED

**The Rhodes Improved Metallic Pkg. Co.**
11 St. Nicholas St., Montreal Limited

**Darling Brothers**
LIMITED

Carry in stock at Montreal, Winnipeg and Vancouver

**STEAM SPECIALTIES**

Single, Duplex and Power **Pumps** and Pumps and Receivers for all services, Oil and Steam **Separators,** Back Pressure **Valves,** Steam **Traps, Exhaust Heads,** Pressure **Reducing Valves,** for all Requirements, **Damper Regulators,** Oil **Filters,** Feed Water **Heaters** and Webster **Heating Apparatus.**

*Write for Catalogues.*

HEAD OFFICE AND WORKS
**3-21 OTTAWA ST., MONTREAL**
TORONTO ST. JOHN, N.B.

**Morehead** RETURN STEAM TRAPS

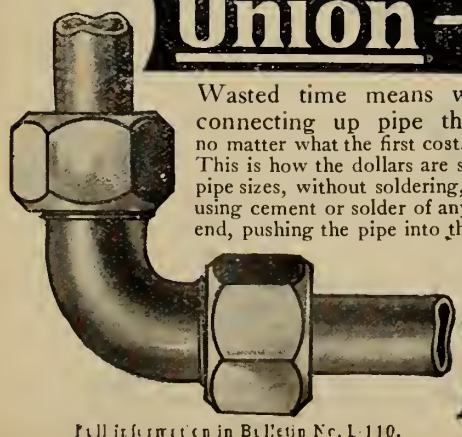
Designed for high or low pressures or vacuum steam service — The same trap can be changed from one service to another or from a system of one pressure to that of another — no special design or changes are necessary. Especially adapted to Boiler Feeding.

Our 1909 illustrated catalogue gives all data and general information.

*Sent on Request*

**MOREHEAD MANUFACTURING CO.,** 1021 Grand River Ave., Detroit, Mich.

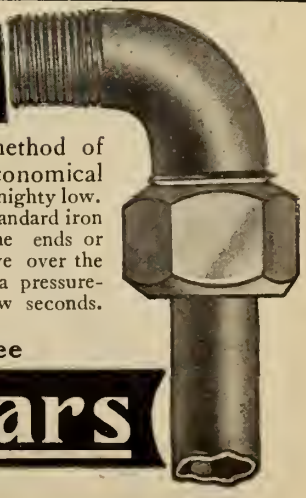
**Union-Cinch Fittings**



Wasted time means wasted dollars—especially to the pipe fitter. A method of connecting up pipe that would POSITIVELY save time would be economical no matter what the first cost. By this method—the Union-Cinch method—the first cost is mighty low. This is how the dollars are saved. Union-Cinch fittings connect up tubing or piping of standard iron pipe sizes, without soldering, flaring out the ends of tubing or pipe, without threading the ends or using cement or solder of any kind. The connection is made simply by slipping the sleeve over the end, pushing the pipe into the fitting and drawing down the nut over same. This forms a pressure-tight joint. UNION-CINCH joints are made tight in a few seconds. Don't forget that every Union-Cinch Fitting is a UNION.

**Sight Feed Oil Pump Co., Milwaukee**

**Save the Dollars**



Full information in Bulletin No. L-110.

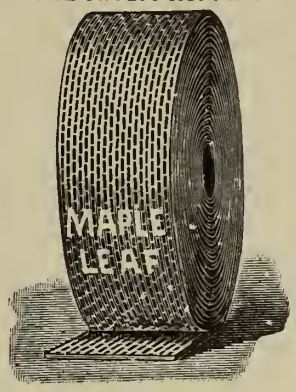
**DOMINION BELTING CO., Limited**
HAMILTON, CANADA

SOLE MANUFACTURERS OF THE CELEBRATED

**"MAPLE LEAF" BRAND**
**Stitched Cotton Duck Belting**
FOR TRANSMISSION OF POWER, CARRYING, ETC

THE TRUEST RUNNING

THE STRONGEST



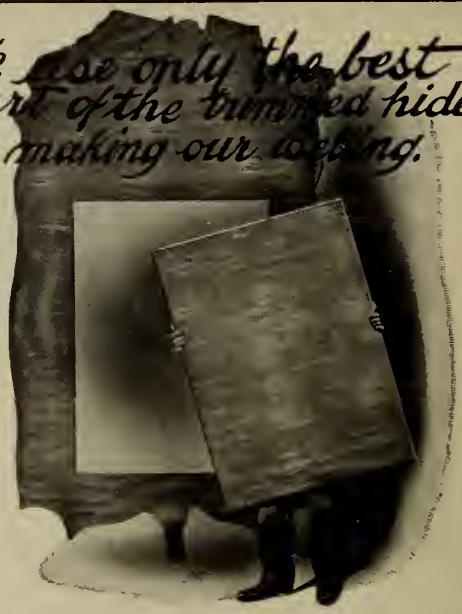

THE MOST ECONOMICAL BELT

MADE IN CANADA

As a Main Drive Belt "Maple Leaf" cannot be excelled. Write for prices.

"MAPLE LEAF" BELT DRESSING is the best on the market for all kinds of belts.

We use only the best part of the trimmed hide in making our belting.



"AMPHIBIA" (WATERPROOF) "CLIMAX"

WRITE FOR PRICES

**SADLER & HAWORTH**

FACTORIES AT
MONTREAL—TORONTO

Branches:—
St. John, N.B., Winnipeg, Calgary, Vancouver

See to it that the next order for lace leather specifies

THE GOODHUE LACE LEATHER
MANUFACTURED BY
J.L.GOODHUE & CO.
DANVILLE, QUE.

The result is spelled
S-a-t-i-s-f-a-c-t-i-o-n.

**THE MAN** who uses belting soon learns that he can save a lot of money by being particular about the quality of belting that people offer to sell him. There are few "snaps" going around that are worth the attention of the belting buyer. It is safer to deal with a firm whose reputation is built on selling belting that gives lasting service. You can insure sound quality every time by ordering D. K. McLaren's Genuine British Oak Tanned Leather Belting. Our regular lines—"EXTRA C" and "STANDARD B" are the best belting in the world for general Power Transmission purposes. We make up special grades to order, promptly and satisfactorily.

WRITE FOR OUR PRICE LIST.

Full stock of our "EXTRA C" and "STANDARD B" carried at all our warehouses

# D. K. McLaren, Limited

MONTREAL
309-311 Craig Street West

TORONTO
200 King Street West

QUEBEC
21 St. Peter Street

ST. JOHN, N. B.
64 Prince William Street

VANCOUVER, B. C.
418 Abbott Street.

EVERY ENGINEER

SHOULD KNOW

ALL ABOUT

WEAR WELL LEATHER PACKINGS

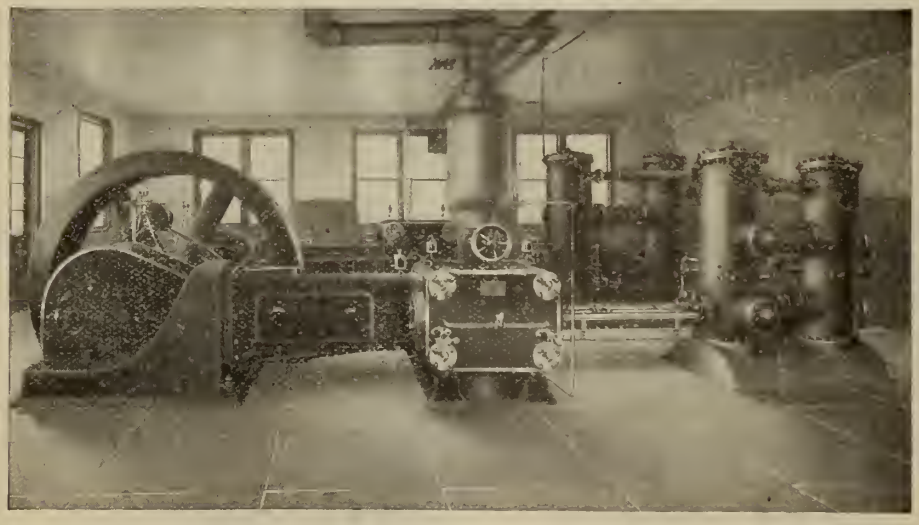
You have packing troubles and have never known where to procure Packings that would give satisfactory service. We manufacture "Wear Well Leather Packings" from the highest quality of leather, work to your specifications and guarantee every Packing to give satisfaction.

Made in all sizes and styles for use in Hydraulic and Compressed Air Machinery. Write for descriptive booklet.

**Detroit Leather Specialty Company, Inc.**

DETROIT 87 Beecher Avenue MICHIGAN

# ROBB POWER PLANTS



**ENGINES**

Corliss, Slide Valve, Horizontal, Vertical

**BOILERS**

Return Tubular, Water Tube, Internally Fired, Portable

**Robb Engineering Co., Limited, Amherst, N.S.**

DISTRICT OFFICES
709 Power Building, MONTREAL; Watson Jack, Manager.
Traders Bank Building, TORONTO; Wm. McKay, Manager.
Union Bank Building, WINNIPEG; W. F. Porter, Manager
Calgary Block, CALGARY; J. F. Porter, Manager.

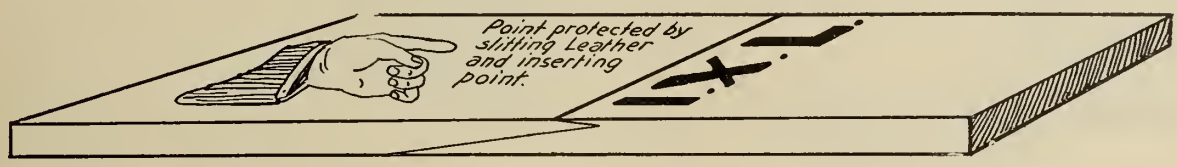
# The "I.X.L." Splice

## "The Belting Splice that will Never Come Open"

The great trouble with *any* belting—no matter how good the leather—that is joined up with the ordinary splice, is the fact that the splices come open, causing loss and delay.

# J. D. McArthur's Leather Belting

Made with the "I.X.L." SPLICE, as shown in this cut, *cannot* come open at the splices. Note the protected point, outside point running same direction as pulley.




This feature is used on no other make of belting. It is especially valuable on fast-running belts, as it prevents trouble and causes the belt to wear much longer than it ordinarily would.

**J. D. McArthur's Leather Belting is made from Prime British Oak-Tanned Leather, from Close-Trimmed Backs exclusively.**

ALL OUR EXTRA QUALITY BELTING IS MADE UP WITH THE PATENT "I.X.L." SPLICE

**WRITE FOR OUR COMPLETE PRICE LIST**

# J. D. McArthur & Co.

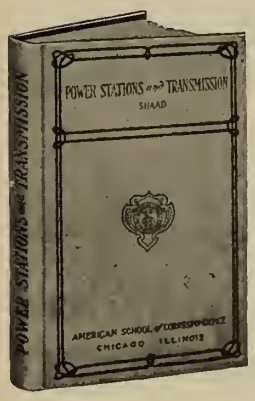
**Manufacturers of Leather Belting from Prime English Oak Leather**

**Brockville, Ontario**

**Stock at Toronto Branch, 639 King St. East; J. E. Stephenson & Co., Agents**

# Practical Books For Engineers

The engineer who would be a success must supplement his practical work by the reading of standard works on engineering. We carry a complete stock of these books, among which are the following:—

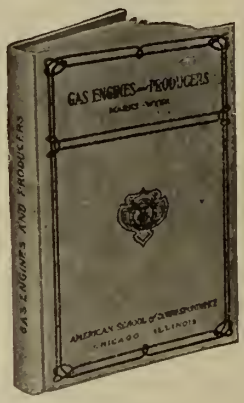



## Power Stations and Transmission

**By George C. Shaad, E.E.**

Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. 176 pp., 43 illus. Cloth binding. A manual for Electrical Engineers and Electrical Workers in general. It represents the accumulation of years of practical experience by the best authorities, and should be in the hands of every worker in the great field of electricity and of every other practical man, no matter what his business, who is interested in the development of electrical power.

**Price.....$1.00**




## Gas Engines and Producers

**By Lionel S. Marks, S B., M.M.E.**

Assistant Professor of Mechanical Engineering, Harvard University, American Society of Mechanical Engineers, and Samuel S. Wyer, Mechanical Engineer, American Society of Mechanical Engineers. 160 pp., 90 illus. Cloth binding. Embodying the latest information in this rapidly developing field. Of immense practical value to all Engineers, Machinists, power-plant owners or managers, etc.,—in fact, all interested in efficient and economical power production.

**Price.....$1.00**

## New Catechism of Electricity

**By N. Hawkins, M.E.**

Price $2.00. 550 Pages, 300 Illustrations.

A practical treatise on the care and management of electric plants and apparatus—a book to aid the average man rather than the inventor or experimenter. It contains all the (book) information necessary for an experienced man to take charge of a dynamo or plant of any size. Contents include Dynamo, Electric Lighting, Electric Railway, Telephone and Telegraph, etc. Bound in red leather, pocket-book form.

## Modern Steam Engineering in Theory and Practice

**By G. D. Hiscox**

Price $3.00. 450 Pages, 400 Illustrations.

This book has been specially prepared for the use of the modern steam engineer, the technical students, and all who desire the latest and most reliable information on steam and steam boilers, the machinery of power, the steam turbine, electric power and lighting plants, etc.

**Further information regarding the above or other Engineering Books given on application to**

# MacLean Publishing Company

TECHNICAL BOOK DEPARTMENT

**10 Front St. East, - Toronto, Canada**

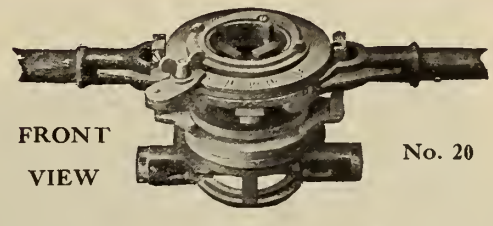
# Every Engineer should own a "BEAVER" Die Stock

With any "Beaver" Adjustable Die Stock you can thread four sizes of pipe without changing dies. The "Beaver" is a far handier and more economical pipe threading tool than the old style stock with which solid dies have to be taken out and replaced by others for every size of pipe. You have only to ***once try*** a "Beaver" to appreciate its value as time saver.

We want you to try a "Beaver" ***at our expense***. We ***know*** you will like it. So we invite ***you*** to ask us for a "Beaver" on 30 days ***free trial***.

If you do not find the "Beaver" to be a handier, more accurate and generally satisfactory tool than any other die stock you ever saw, send it back to us ***collect.***

——Do it now——



FRONT VIEW No. 20

With this tool, one man or boy can easily thread 1-in., 1¼-in., 1½-in. and 2-in. pipe without changing dies.

No. 4 "BEAVER"

Cuts 2½-in., 3-in., 3½-in., 4-in. pipe. With a ratchet handle, one boy can thread 4-in pipe.

FRONT VIEW No. 6 "BEAVER"

Cuts ¼-in., ⅜-in., ½-in. and ¾-in. pipe, using two sets of dies. Both sets are operated by single cam, so constructed as to move one set of dies back while the other set is in use.

## Borden-Canadian Company

66 Richmond Street East

TORONTO

RAPID WORKERS

RAPID WORKERS

# Power Equipment

## Our Engines, Boilers, Heaters, Pumps, Condensers, etc., are prominent in Canada's Largest Power Stations

BECAUSE THEY ALWAYS GIVE PERFECT SATISFACTION

Standard Type of Ontario Boiler, 18 feet long and under.

## WE BUILD FOR POWER HOUSES

**Wheelock Slow Speed Engines, Goldie Corliss Engines, Ideal High-speed Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Return Tubular, Water Tube, Horizontal Marine, Vertical and Portable Boilers, Heaters, Pumps and Condensers**

## The Goldie & McCulloch Co., Ltd.

Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

B.C. AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

# Convention of Canadian Association of Stationary Engineers

## Full Report of the Twentieth Annual Convention at London—Will Meet at Berlin in 1910—C.A.S.E. Exhibitors Association and Exhibits.

The twentieth annual convention of the Canadian Association of Stationary Engineers opened Tuesday morning, July 27th, 1909, at the City Hall, London. The place of meeting was decorated with flags and bunting for this occasion. The main hall was placed at the disposal of the C.A.S.E. Exhibitors' Association for the exhibit of engineers' supplies, a room being reserved for the meetings of the engineers.

At 10.30 Tuesday morning there was a grand opening at which were civic representatives, all visitors and ladies.

Acting Mayor D. Stewart welcomed the C.A.S.E. in a well chosen address. He said that he was pleased to have the pleasure of welcoming the engineers to the city, and also offering the freedom of the city to the delegates of the Canadian Association of Stationary Engineers.

"We have a most beautiful city here," said the alderman, "about 50,000 population, and the fourth largest in the province. We have the most beautiful parks, trees and flowers, and as to our beautiful water supply, which comes from Springbank, I hope that of this you will partake freely. We have some 228 factories, among them some of the largest in Canada, and schools, a medical college, a university, hospitals, which are second to none in Canada, and we would be pleased to have you while you are in the city call and inspect any of these.

### Producer Gas Engines.

"In the city we have two factories which have installed the gas producer engines, and this question is causing much discussion in the city at the present time on account of the hydro-electric power question, and it might be of some interest to the engineers to visit these factories.

"Among the factories that we have in the city are some of the largest cigar factories in Canada, and two breweries that are known all over the country, and these you are also invited to inspect."

In closing, the speaker extended an invitation to the convention to again assemble in this city. He was pleased to see conventions visiting the city and meeting here.

In his opening address Chairman Kelly welcomed the delegates in attendance, and hoped that they would profit by the convention. He was pleased to see a good number of the ladies present.

He had heard that the local members were instrumental in having a couple of extra police added to the force while the convention was on, but he said that as it was just the engineers' day off he hoped that they could steer clear of them.

### Board of Trade Welcome.

Adam T. McMahen, on behalf of the London Board of Trade, extended the welcome of that body to the engineers, and hoped that they would enjoy themselves at their convention. He also offered the free use of the board of trade rooms to the members while meeting in the city.

City Clerk Baker was also called upon and spoke a few words of welcome to the delegates.

W. A. Crockett, executive secretary of the engineers, was called upon, and replied to the address of welcome from the acting chief magistrate and other speeches of welcome. He thanked the speakers for their generous offer of the freedom of the city, and felt sure that the delegates were pleased to have such a beautiful city at their disposal. He thought that it would be a good idea to have the convention discuss the question of gas producer engines before they adjourned.

C. Kelly, Chatham, executive president, was in the chair. The following executive officers were present :Past President, E. Grandbois, Chatham ; President, C. Kelly, Chatham ; Vice-President, W. C. McGhie, Toronto ; Conductor, J. J. Heeg, Guelph ; Door-keeper, W. Norris, London ; Secretary, W. A. Crockett, Mount Hamilton.

After the reception ceremonies, Bro. Kelly named the committee on credentials :—Bros. W. A. Crockett, Hamilton; E. Grandbois, Chatham ; and C. Moseley Toronto.

Stri'ing and standing committee :—Bros. W. C. McGhie, W. Norris, E. Taylor, J. J. Heeg, and W. E. Archer.

C. KELLY,
Executive President.

W. C. McGHIE.
Past President.

J. HEEG.
Vice-President.

The C. A. S. E. Ladies' Auxiliary, Delegates to C. A. S. E. Convention and Supplymen at London Convention, July, 1909

As no further business could be gone on with the meeting adjourned to meet at 1.30 p.m.

### TUESDAY AFTERNOON.

The credential committee reported that there were 29 delegates present and that they had filed their credential cards. Moved by Bro. Frank Stubbs, seconded by Bro. Leckie, that the report of the striking committee be accepted. Carried.

The following committees were elected :

Committee on the Good of the Order : Bros. W. E. Archer, Toronto ; G. Moll, London ; H. R. Clarke, Hamilton ; E. J. Taylor, Kingston ; H. S. Williams, Guelph ; W. H. Bradt, Windsor ; C. Peppin, Belleville ; Harry Creagon.

Mileage and per diem committee :— Bros. W. A. Crockett, Ed. Grandbois, and C. Moseley.

Ways and Means committee :—John G. Bain, H. J. Wickens, J. A. Fuhrman, J. Fulcher, B. Roberts, Wm. Walters and S. Cosford.

Laws committee :—Bros. F. Stubbs, C. A. Leckie, W. Norris, J. Ogle, Jno. Head, Wm. Caswell and W. Johnson.

Moved by Bro. W. E. Archer, seconded by Bro. J. J. Heeg, that on account of the minutes having been printed and read they be confirmed. Carried.

Moved by Bro. E. J. Taylor, seconded by Bro. Caswell, that the secretary's report be received and handed to the committee of the Good of the Order. Carried.

The report of the treasurer was read by Bro. Crockett.

Moved by Bro. Bradt, seconded by Bro. H. R. Clark, that the report of the treasurer as read by Bro. Crockett be accepted. Carried.

Moved by Bro. A. M. Wickens, seconded by Bro. E. J. Taylor, that the report of the executive president be received and handed to the committee on the Good of the Order. Carried.

Notice of motion was given by Bro. W. E. Archer, Toronto, as follows :— In order to assist in strengthening the financial condition of the executive funds Toronto branch, No. 1, hereby give notice that they will move through their first delegate, "That no more than 50 per cent. of the per capita tax paid into the Executive Council be returned to any association in delegates' fees."

Moved by Bro. E. J. Taylor, seconded by Bro. G. Moll, that the notice of motion be handed to the committee on the Good of the Order. Carried.

Car 23 and the Crowd of Engineers and Supplymen Returning from the Kennels.

### President Kelly's Letter.

London, July 27th, 1909.

To the officers and delegates assembled in convention.

Brothers :—

I your Executive President for 1908-09, beg leave to submit to you an account of my stewardship.

The year just passed and gone has been one of great pleasure for me, everything seemed to go along smoothly, nothing to mar our harmony.

During the year I was asked by the Supplymen's Association to give them the privilege of using our letters C.A.S.E., to be known as the C.A.S.E. Supply Association. Being a disbeliever in one man power, I called a meeting of the executive which convened at Toronto in October last, to which all the executive responded. The matter was taken up and discussed from every standpoint and finally passed in their favor.

During the year three new associations were organized in the following places : Belleville, North Bay and Brampton. These associations have been organized under very favorable circumstances and will be a good addition to our society. While we regret not being able to organize more new associations yet we are pleased to note that all other associations have been materially strengthened by the addition of new members.

Our finances are in good shape as the report of our executive secretary and treasurer will show.

We are also pleased that the law respecting engineers has been put in workable shape, though I believe some amendments would be of great value,

A. M. WICKENS.
Executive Treasurer.

W. NORRIS.
Executive Conductor

W. A. CROCKETT.
Executive Secretary

such as graded certificates. To this end I would recommend that a petition be drafted and sent to the various associations signed, and presented to the Minister of Agriculture asking the law to be amended along these lines.

I also recommend that some definite action be taken regarding the ladies' auxiliary. I would further recommend that the opening and closing ceremonies of convention be made public so that all visitors (ladies included), can take part.

In conclusion I wish to thank the executive officers for their kindness toward me during the year, especially our executive secretary, Bro. Crockett, who with his untiring efforts has done much to make this a successful year. Again thanking you all for the honor conferred I remain, fraternally yours,

CHAS. KELLY,
Executive President.

The Engineers and Their Friends Visiting London Asylum.

**Executive Secretary's Letter.**

London Convention, July 1909.

To the Executive President and Brothers :—

Once more I have the honor and pleasure of presenting to you a report of the deliberations and proceedings of the Executive Council of the C.A.S.E. for the 19th annual convention which was held in Windsor in August 1908 : and also a brief mention of the work done during the year 1908-1909.

We have added to our ranks three new lodges, Belleville, North Bay and Brampton and our thanks are due to the exertions of Bros. W. Cooke, Belleville, W. J. Wilkinson, North Bay, and H. J. Wickens, Brampton for bringing to maturity the good work that had been performed in their respective localities.

I am pleased at the manner in which all the lodges responded to the circulars sent out to them and regret that lack of time prevented me from doing more.

Enquiries have been made and the correspondence voluminous, as you will see.

The engineers of Sarnia, Lindsay, Cobalt, Port Hope, Brockville, and Becchlane have shown their interest in our association and its aims, and have intimated their intention towards us.

It is being more fully realized to-day than ever before the duty which devolves upon every engineer in the Dominion, also the urgent necessity for all to aid and assist to their fullest extent in getting laws enacted which will tend to raise themselves to a higher plane in the engineering profession.

The present time of our association is when "the metal of the man is tried." Every movement that has for its aim the benefit of the majority is held together by a certain amount of sentiment or sympathy. No matter by what name it may be called, it means the life of the movement and as such, every effort should be put forth by all interested so as to become a greater factor.

The license law has become operative and we are pleased to see that the C.A.S.E. has not been forgotten. Brother W. C. McGhie has been appointed chairman of the Board of Examiners with Brother C. Moseley as an associate, and while the law has not been exactly what it was intended or expected to be from our standpoint, still we must not forget that it is a beginning and we trust will get better as time rolls on. I wish to thank all for the courtesy shown to us.

Our finances are in good healthy condition. We are growing, as the statement will show.

As many lodges have requested their delegates to bring back a detailed statement it is presented in that form.

W. R. STAVERT,
President Exhibitors' Association.

W. H. BRADT,
Executive Doorkeeper.

J. B. GOFF.
Secretary C.A.S.E. Exhibitors' Association.

I desire to recommend that the Good of the Order Committee will carry out for the betterment of our position, the following :—

THE ENGINEERS' BASEBALL TEAM.

Top Row—Moll, Taylor, Grandbois, Leckie, Heeg, Archer, Metcalf, McGhie, Moseley.
Front Row—Russell, Rumage, Johnson, Clark.

1. The advisability of getting the government to grant or endorse a graded certificate (this to be optional with the engineer.)

2. The advisability of making allowance for the executive president to visit localities where his efforts can be used to get new lodges.

3. To make allowance for visiting every lodge once a year at least.

4. The advisability of adopting or endorsing a resolution adopted by the London Board of Trade re boiler inspection.

5. The adoption of a set of questions to be used by all subordinate lodges for the examination of candidates.

**Statement.**

| | | |
|---|---|---|
| Bal. cash on hand | $264.73 | |
| To Treasurer direct | 148.24 | |
| Cash from Secretary | 147.00 | |
| Sec. Postage, etc. | 29.83 | |
| Cash from Secretary | 222.72 | 812.52 |
| Cash on hand | 339.18 | |
| Total expenditure | 473.34 | 812.52 |

Yours Fraternally,
W. A. CROCKETT.

Moved by Bro. E. J. Taylor, seconded by Bro. F. Stubbs, that we do now adjourn to meet at 9 a.m., Wednesday morning the 28th.

**After Business, Pleasure.**

At two o'clock all adjourned to the wharf at the foot of Dundas Street, where a number of the motor boat owners of London were ready to convey the engineers and their lady friends to Springbank.

The trip was a pleasant one and much enjoyed. The delegates are much indebted to the owners and G. E. Fisher, of the Fairbanks Co., for the trip.

On the arrival at the pumphouse all adjourned to the baseball diamond, where a ball game was played between the engineers and the peddlers.

The line-ups were as follows : Engineers—Metcalfe, pitcher ; Lackie, catcher; Taylor, first base ; Heeg, second base ; Moseley, third base ; Moll, short ; Grandbois, right field ; McGhie, left field, and Russell, centre field.

Supply : Rowell, pitcher ; Austin, catcher ; Carmichael, first base ; Cole second base ; Hetherington, third base; Wilkinson, short ; Tyrrell, right field; Coff, left field; Fisher, centre.

Umpire—Clark.

Official Rooter—Rumage.

The peddlers were "too fast" for the engineers who tried to put on more steam. When the final score was given out the indicator cards of the supplymen showed 7, while the engineers showed only 3.

SUPPLYMEN'S BASE BALL TEAM.

Top Row—Clark, Tyrrell, Goff, Rumage, Wilkinson, Cole, Hethrington, Stavert.
Front Row—Carmichael, Austin, Fisher, Rowell.

Following the ball game was an interesting programme of races :

1. 100 Yard Dash (open to all high steppers with boots under No. 12)—(1) Gifford, (2) Austin, (3) Hethrington.

2. Ladies' 75-Yard Dash (no age or waist limit. Gentlemen are requested not to feed or offer candy to contestants)—(1) Mrs. Fletcher, (2) Mrs. Bain, (3) Miss Wickens.

3. Donkey Race (no braying permitted. Contestants should not wag their ears nor resist their mounts)—(1) Austin and Cato, (2) Galloway and Garfat, (3) Russell and Moll.

4. Wheelbarrow Race (open to any nation, including Italy)—(1) Armer and Gifford, (2) Austin and Hethrington, (3) Russell and Moll.

5. Ladies' Spoon-Potato Race ; (note—the potatoes should not be eaten until after the race)—(1) Miss Margaret Taylor, (2) Mrs. England, (3) Mrs. Bain.

6. Fat Man's Race (open only to men whose waist measure is 42 19-64 or over ; no blowing out allowed)—(1) Carmichael, (2) Heeg, (3) Moseley.

7. Supplymen's Smoking Race—(1) Pettie, (2) Gifford, (3) Tyrrell, (4) Armer.

The prizes, including umbrellas, knives, etc., were presented by Acting-Mayor Stewart of London, at a supper in the pavilion.

The engineers then adjourned to the theatre where "The Chorus Lady," was played. As a special, H. H. Cato, of Jenkins Bros., Montreal, favored the audience with a couple of interesting songs.

The entertainment for the afternoon and evening was provided by the C. A. S. E. Exhibitors' Association.

**WEDNESDAY MORNING.**

The Executive President appointed Bro. H. R. Clark to be assistant secretary. The Executive President also appointed Bros. E. Grandbois and S. Cosford to be auditors on account of the

former two appointed not being in attendance at this convention (Auditors Bros. G. W. Dawson and Tait).

Moved by Bro. T. E. Archer, seconded by Bro. E. J. Taylor, that the action of the president in appointing the new auditors be sustained. Carried.

Moved by Bro. W. H. Bradt, seconded by Bro. G. Moll, that hereafter sessions be held in secret. Carried.

The Donkey Race. It was Lots of Fun—For the Spectators.

The following brothers spoke on the suggestion to set apart the first day of the next convention for the transaction of business only: Bros. C. Moseley, H. J. Wickens, W. H. Bradt, W. E. Archer, W. Norris, J. J. Heeg, G. Moll, H. Craigon, E. Z. Taylor and W. Johnson.

Moved by Bro. C. Moseley, seconded by Bro. H. J. Wickens, that the above suggestion be handed to the committee on the Good of the Order. Carried.

At this stage there being some misunderstanding respecting the wording of the No. 2 clause of the report of the committee on the Good of the Order, it was moved by Bro. E. J. Taylor, seconded by Bro. C. Peppin, that we do now adjourn for the space of 1½ hours to give the committee time to reconsider the clause mentioned. Carried.

Convention adjourned at 12.10.

## WEDNESDAY AFTERNOON.

The delegates and supplymen were taken to the Kennels at 1.30 in special cars and were entertained at a most enjoyable luncheon, given by the firm of E. Leonard & Sons. During the afternoon Mr. F. E. Leonard read a most interesting paper on "Boiler Construction," dealing with the subject from the standpoint of the manufacturer, who, under the present laws in force in different provinces, has to make many different kinds of boilers in order to live up to the law. He strongly urged the C. A. S. E. to lend their efforts towards securing a standard boiler, which could be sold in any province, and which by means of its possessing all the requisites could be accepted in any province. As the laws now stand there is a vast difference between the thickness of plate required in Ontario and Quebec. To meet the requirements of British Columbia still another standard is necessary, and so on with each province. In addition there are a host of minor details embodied in the laws of the different provinces, which puts the manufacturer to a lot of trouble and inconvenience to comply with. Mr. Leonard thought there should be a standard boiler for the whole of Canada. The parts should all be standard also, so that if anything happened to any of them they could instantly be replaced by an exact duplicate.

Bros. A. M. Wickens and W. A. Crockett spoke favoring a uniform law and pointed out the advantages of the butt joint.

The delegates were then taken in a special car to the asylum, and with the lady friends, were shown all over the institution and grounds.

At six o'clock all the different committees of the association met in the city hall and considered the questions and regulations before them. They prepared their reports and had them ready for the convention when it convened Thursday morning.

## WEDNESDAY EVENING.

About 140 engineers, supplymen and their lady friends attended the banquet which was a great success. The dining room of the City Hotel presented a gay scene and all did credit to the sumptuous repast.

### Toast List.

"The King."

Chairman's Address—Bro. C. Kelly, Chatham.

"Mayor and Corporation City of London."

"Board of Trade, London."—A. T. McMahen, President Board of Trade.

Solo—Mrs. Coutts-Bain, Toronto.

"Our Association"—Bro. W. A. Crockett, Mount Hamilton.

Song—H. H. Cato, Montreal.

"Legislature"—Hon. Adam Beck, M. P.P., London.

"Canada"—Major Beattie, M.P., and F. E. Leonard, London.

"Board of Education"—Col. Gartshore and John M. Gunn, London.

"Subordinate Lodge"—Bro. W. Norris, London.

"Exhibitors' Association"—W. A. Stavert, Montreal.

"Ladies"—G. C. Keith, Editor The Power House, Toronto.

"The Press"—J. C. Armer, Editor The Canadian Manufacturer, Toronto.

### Chairman's Address.

Chairman Kelly, in opening the programme of speeches, spoke of the benefits resulting from meetings such as the annual convention of the C. A. S. E. He extended a very warm welcome to all present.

The toast to the Board of Trade was responded to by A. T. McMahen.

"I am sure," he said, "I feel greatly honored to be with the engineers. I am proud to have my name coupled with such an important toast affecting as it does the commercial interests of the city. Canada came through the financial stringency much better than the large majority of other countries, and this shows that our banking system is unsurpassed. I believe we are entering upon a period of prosperity such as Canada has never known before. In the future I hope we may take some steps

Wales, "Car" and "Wilkey" Discover Something Attractive in the Top Storey of London Asylum.

to assist England in maintaining her fleet and army.

### The Engineers.

"Our Association" was ably responded to by W. H. Crockett, of Hamilton, executive secretary of the C. A. S. E.

"When I came here two years ago," said Mr. Crockett, "to put London Lodge, No. 30, on a foundation, it was with some hesitancy. We were not sure

then that we would have the sympathy of the manufacturers. Now we have that, and what is more, we have the Government behind us. Since coming here we have been royally entertained, and could not have been better treated, and on behalf of the C.A.S.E., I assure you, will carry away the very pleasantest remembrances of London and its people. We have all been struck while here with the large number of handsome homes owned by workingmen. London has such a showing in this respect that any city might be proud of. We are living in a time when we are said to be a nation, and in a century that belongs to Canada. We all, manufacturers and employes alike, should try to settle all differences and troubles in a most amicable manner, and try to build up Canada's industries fitting to a great nation."

### Hon. Adam Beck.

Hon. Adam Beck responded to the toast to the "Legislature." He congratulated the C. A. S. E. on the splendid arrangements they had made throughout.

"I join with you in trade," he said, "as I served my time some 30 years ago in my father's shop when the first Corliss engine was made there. You will find the Government always ready to help you keep abreast of the times, and we recognize that your claims that all engineers should be properly qualified is a proper one, and you will find that you will constantly get more and more recognition."

### "Canada."

The toast to "Canada" was responded to by Major Beattie and Mr. F. E. Leonard.

"The C.A.S.E." said Major Beattie, "has already made its mark in Canada, and has done great good. Many of us can remember disastrous explosions. In Canada this state of affairs is rapidly passing, and the C. A. S. E. is doing a great work."

F. E. Leonard said that there were some things that in our moments of prosperity we must not overlook. We must have good laws. To do so we must have good legislators. An important feature was the bringing to Canada of the right class of people. He was very pleased to see considerable criticism in the press regarding certain classes of immigration. We should welcome all people healthy and willing to work. Such people can be made Canadians and good citizens.

### Col. Gartshore.

"One of the principal objects of the C. A. S. E.," said Col. Gartshore, in responding to the toast to the board of education, "is education. Our young men need it more than anything at the present time. They are too apt to look at the present, however, and not at the future at all. They want money to spend, and when they get it, spend it recklessly. All manufacturers can testify to the difficulty of getting men to qualify for the higher and better paid positions. Many of the older men, however, could have qualified in their teens for positions they are trying to qualify for now. In your efforts to obtain graded certificates I would suggest that three grades be instituted, and that all men who receive the highest certificates should also receive the highest pay."

John M. Gunn, replying to the same toast, expressed himself strongly in favor of establishing technical schools for the training of engineers and others.

OFFICERS OF THE C. A. S. E. EXHIBITORS' ASSOCIATION.

Top Row—Austin. Hethrington. Keith. Front Row.—Fisher. Stavert. Goff.

### Subordinate Lodges.

The toast to the subordinate lodges was responded to by Bro. Wm. Norris, and he urged engineers and employers to try and co-operate in every way. The C.A.S.E. policy is along this line.

A pleasing closing function of the banquet after Mr. W. A. Stavert had replied to the toast of the association, took place when Miss Johnston of Owen Sound, presented Mr. Stavert with a beautiful bouquet. Mr. Stavert replied to Miss Johnston in a most appropriate manner.

During the evening the Manchester Quartette, Galt, gave several selections and responded to encores.

### Those Present.

Those who attended the banquet were W. R. Stavert, F. E. Leonard, Major Beattie, W. A. Crockett, Charles Kelly, A. M. Wickens, Col. W. M. Gartshore, A. T. McMahen, J. M. Gunn, G. C. Keith, W. Norris, J. C. Armer, J. G. Bain, Miss M. Coutts, Mrs. Coutts-Bain, J. Gregory, Mrs. J. Gregory, Mr. and Mrs. W. C. McGhie, Mr. and Mrs. Charles Moseley, Mr. and Mrs. A. M. Wickens, Mr. and Mrs. J. A. Robertson, Fred Davenport, W. Costello, R. A. Root, T. A. Meyers, W. G. Rose, J. C. Greason, J. Pink, Mr. and Mrs. R. M. Simmie, Mrs. S. E. Cosford, Mr. and Mrs. S. S. Glass, Mr. and Mrs. A. L. Fletcher, Mr. and Mrs. D. Frederick, W. Johnson, Mrs. and Miss W. Johnson, Miss Amelia Crockett, Mrs. W. A. Crockett, Mrs. W. Norris Miss M. S. Baker, Dr. W. W. English, W. Bowers, D. O. McKinnon, H. R. Least, John Head, Alex. Lackie, E. R. Grandbois, Mr. and Mrs. England, Mr. and Mrs. D. F. Campbell, Mr. and Mrs. W. G. Walter, Mr. and Mrs. W. F. Taylor, Mr. and Mrs. James F. Reid, Mr. and Mrs. W. C. Garfatt, Mr. and Mrs. A. T. Braithwaite, Lillian Braithwaite, Mr. and Mrs. D. F. Freedy, Joseph Fitzpatrick, Mr. and Mrs. Galloway, Joseph A. Fuhrman, Ernest A. Wilkinson, J. R. Stephenson, P. McDonald, Mr. and Mrs. Geo. Moll, A. W. Carmichael, John J. Heeg, W. J. Paynter, J. B. Latour, Mr. and

Mrs. R. Rodda, Mr. and Mrs. W. R. Colby, D. M. Metcalf, Alex. Storer, J. Ironside, W. D. Bradt, G. Barnes, W. Sutton, W. J. Wilkinson, G. Wells, James Fleteher, W. E. Archer, C. J. Pymm, E. J. Taylor, W. G. Alfred, H. Creagon, T. H. Rumage, H. E. Rowell, H. Hosdell, John Taylor, A. Russell, J. Ogle, J. B. Goff, W. C. Austin, H. V. Tyrrell, Hon. Adam Beck, J. Abell, G. Fisher, A. J. Gormly, P. Gifford, W. McCutcheon, E. Hethrington, W. Hewswood, E. Cody, A. W. Pettie, H. H. Cato.

**The Committee.**

The committees in charge of the arrangements were as follows :

Reception—G. Fowler, R. Lyons, F. D. Campbell, G. Moll.

The Supplymen at the C.A.S.E. 20th Annual Convention, London, July 1909, W. R. Stavert, Pres. Exhibitors' Association is in the Centre of front row with W. Norris, Hon. Pres., at his Right.

Printing—S. S. Glass, A. T. Braithwaite, J. E. Middleton, J. R. Stephenson.

Entertainment — S. Cosford, G. F. Galloway, Geo. England, Wm. Norris, chairman ; W. Costello, secretary.

**THURSDAY MORNING.**

Moved by Bro. S. B. Walters, seconded by Bro. W. E. Archer, that the report of the Mileage and Per Diem Committee be adopted. Carried.

Moved by Bro. C. Moseley, seconded by Bro. J. J. Heeg, that the report of the Laws committee be taken up clause by clause. Carried.

Report of the Laws Committee : Clause 1, Re Bi-annual conventions : — This committee recommends that it be not entertained.

Moved by Bro. F. Stubbs, seconded by Bro. C. A. Leckie, that it be not entertained. Carried.

Clause 2—Re subordinate secretary being placed on the same level as a subordinate Past President : This committee recommends that this matter be left in the hands of each subordinate lodge to deal with as they may deem fit and proper ; provided that whatever action they may take, is endorsed by the executive.

Moved by Bro. F. Stubbs, seconded by Bro. C. A. Leckie, that this clause be adopted. Carried.

Clause 3—Re granting of a suitable token to an executive secretary who has served three years or more, this committee recommends that some suitable token be granted for services rendered for three consecutive years and that it be distinguishable from a Past President's jewel.

Moved by Bro. F. Stubbs, seconded by Bro. W. H. Bradt, that this clause be adopted and that the Executive be a committee to look after same and present it to Bro. Crockett. Carried.

Moved by Bro. McGhie, seconded by Bro. J. J. Heeg, that the full report of the Laws Committee be adopted. Carried.

**Report of Ways and Means Committee.**

Clause 1—We recommend that the motion from Toronto No. 1 that not more than 50 p.c. of per capita tax received from any lodge be returned to any association in delegates' fees be adopted.

Clause 2.—That the funds necessary for visiting subordinate lodges be drawn from the remaining 50 p.c.

Moved by Bro. F. Stubbs, seconded by Bro. C. Moseley, that these recommendations be adopted

After a general discussion in which nearly all the delegates took part it was moved by Bro. H. R. Clark, seconded by Bro. W. H. Bradt, that this report be adopted. Carried.

**Report of the Good of the Order Committee.**

Clause 1—Re graded certificates.

Moved by Bro. W. E. Archer, seconded by Bro. H. Creagon, that this clause be adopted and that a copy of this resolution be sent to the Government asking to have the matter taken up believing that it is for the welfare of the country manufacturers and employes. That the graded certificates be not compulsory, but optional with engineers. And that a copy of this resolution be sent to the Chairman of the Examining Board. Carried.

Clause 2.—Your committee recommends that the sum of $50 be placed to the credit of the Executive secretary for the organization of the ladies' auxiliary.

Moved by Bro. W. E. Archer, second-

ed by Bro. W. C. McGhie, that this re-
Moved by Bro. W. E. Archer, seccommendation be adopted. Carried.
onded by Bro. W. C. McGhie, that this recommendation be adopted. Carried.

Moved by Bro. Archer, seconded by Bro. E. J. Taylor, that the report of committee on the Good of the Order be adopted. Carried.

Moved by Bro. W. E. Archer, seconded by Bro. E. J. Taylor, that the recommendations of the executive secretary be adopted. Carried.

Moved by Bro. E. J. Taylor and seconded by Bro. C. J. Peppin, that the C.A.S.E. in convention assembled do unanimously endorse the principle of Uniform Boiler Construction and Inspection Laws as proposed by the Canadian Manufacturers' Association, and that the Executive Secretary forward a copy of this resolution to the proper authorities under the seal and signature of the Executive President and Secretary. Carried.

L. H. RUMAGE

Official Rooter at the Ball Game. Posing for The Power House Camera.

Moved by Bro. E. J. Taylor, seconded by Bro. W. H. Bradt, that the first day of the convention be devoted entirely to business and that the hours of business be 11 to 12 a.m. and 1.30 p.m. to 4.30 p.m., and to be no night session, that the 2nd day, 9 to 12 be for receiving committee reports and other business. Afternoon and evening to be free, that the 3rd day, 9.30 a.m. till finish of business, and that this time table be embodied in the order of business of the Executive Council. Carried.

Moved by Bro. Creagon, seconded by Bro. Moll, that an official detailed report of the finances of the Executive Council be sent to each subordinate lodge to be spread upon the minutes of the subordinate lodge and to be read at three of their meetings. Carried.

Moved by Bro. Creagon, seconded by Bro. C. H. Peppin, that this Association request the secretary to forward to employers of engineers attending convention a full report of the proceedings at convention and also that the secretary notify each employer of a delegate that his engineer has been elected as a delegate and request that he be afforded opportunity to attend. Carried.

Moved by Bro. W. E. Archer, seconded by Bro. C. Peppin, that the recommendation of the committee on the Good of the Order, that a standard set of examining questions for candidates to subordinate lodges be drafted by the Executive Board, also a set of rules for the guidance of the examiners be adopted. Carried.

Moved by Bro. H. Creagon, seconded by Bro. E. J. Taylor, that the following recommendation of the committee on the Good of the Order be adopted. Carried. Re opening and closing ceremonies, we beg leave to recommend that the opening ceremony only be open to the public until such time as a service of installation can be prepared for the closing ceremony.

Moved by Bro. H. R. Clark, seconded by Bro. H. Creagon, that the report of the treasurer be received. Carried.

Bro. Walter, Stratford, asked several questions relating to the new license law and its working. Bro. W. C. McGhie replied and gave some very useful information which was well appreciated.

Moved by Bro. C. A. Leckie, seconded by Bro. S. Cosford, that a vote of thanks be tendered to Bro. McGhie for his able address. Carried.

### Address on Steam Turbines.

An address that was listened to with much interest was that of Bro. Chas. Moseley, of Toronto, chief engineer of the Toronto Electric Light station. Mr. Moseley spoke on "Steam Turbines," and told of his earlier experiences in handling turbines.

"I was in charge of four 500 kilowatt turbines, but no test was made as to their efficieney because circumstances at that time did not warrant it. Some time afterwards a 2,000 k.w. turbine was installed and on this there was a test made. When the test was made it was understood that a vacuum of 27½ in. would be maintained at the pumps. The steam consumption was to be about 20½ pounds per k.w.

"I noticed that when the pumps were not working exactly as they should and when we only got about 24 in. of a vacuum the steam consumption was so heavy that it was almost impossible to keep up steam, the boilers not being able to supply it. However when the vacuum was around 27, 28 and 29 in., especially about 27½ in., the boiler capacity was fully ample.

"There was a flow meter attached to the steam supply and it worked splendidly; in fact I think it is just the thing to get an estimate of what is doing in that line. It is necessary to have superheated steam if extra results are expected. The conclusion I have come to is that the blades of the reciprocating parts should be carefully gone over to see that they are perfectly smooth, also that no blow holes are in the stationary parts as this tends to create friction and means a loss of energy. If there are any rough spots at all, the steam is not given a chance. Every part must be quite smooth if good results are expected. Seeing that there is only about 45-100 in. between the easing and turbine, if it should get unbalanced by vibration, it would cause a loss of steam."

### Gas Engines.

Brother Grandbois, of Chatham, who is in charge of the gas plant there, stated in a paper on "Gas Engines" that provided everything worked satisfactorily, gas power was much more economical than steam. There were, however, so many little kinks, especially in the larger units, that often some difficulty was experienced in getting the same amount of energy as from steam.

Moved by Bro. Roberts, seconded by Bro. E. J. Taylor, that we adjourn to meet at 1.30 p.m. Thursday afternoon, July 28th.

## THURSDAY AFTERNOON.

Meeting called to order at 1.30 p.m.

Bros. C. Moseley, E. J. Taylor and John Head were appointed scrutineers, J. J. Heeg conductor, and C. A. Leckie, assistant conductor.

### The New Officers.

The election of officers was as follows :—

President—W. C. McGhie, Toronto.
Vice-President—J. J. Heeg, Guelph.
Secretary — W. A. Crockett, Mount Hamilton.
Treasurer—A. M. Wickens, Toronto.
Conductor—W. Norris, London.
Doorkeeper—W. H. Bradt, Windsor.

At this stage of the proceedings Bro. W. C. McGhie desired to resign. Moved by Bro. W. E. Archer, Toronto; seconded by E. J. Taylor, Kingston, that Bro. McGhie be allowed to resign and retire with the honors of office, and that Bro. C. Kelly, of Chatham, still keep the position of President for the ensuing year. Carried.

Moved by Bro. A. M. Wickens, seconded by Bro. W. A. Crockett, that D. O. McKinnon of the Supplymen's Association be given privilege to address the meeting. Carried.

Mr. McKinnon in a very able manner pointed out the value of co-operation and trusted that the best of feeling and harmony would permeate the two bodies and that they would dwell together in unity. He brought to the notice of the association the advantage of having papers read by competent engineers, before the association, and of inviting all engineers to be present at the convention and listen to the papers and the discussion on same. A committee had been appointed by the Supplymen's Association with this in view to bring the matter to the attention of the C. A. S. E., and co-operate with them to broaden the sphere of the C.A.S.E. and Supplymen's Association by setting apart a day for the reading and discussion of papers.

Moved by Bro. A. M. Wickens, seconded by Bro. H. J. Wickens, that a committee be appointed to confer with a committee from the Supplymen's Association. Carried. Committee—Bros. A. M. Wickens, W. A. Crockett and W. Norris.

Moved by Bro. J. Ogle, seconded by Bro. C. Moseley, that $5 be granted to the caretaker of the hall. Carried.

Moved by Bro. C. Moseley, seconded by Bro. F. Stubbs, that it be left to the executive officers to get token for the secretary. Carried.

Moved by Bro. C. Moseley, seconded by Bro. Bain, that $25 be granted to the secretary. Carried.

Moved by Bro. Bain, seconded by Bro. G. Moll, that $10 be granted to the treasurer. Carried.

Moved by Bro. W. E. Archer, seconded by Bro. J. J. Heeg, that a vote of thanks be tendered to the scrutineers. Carried.

Moved by Bro. A. M. Wickens, seconded by Bro. G. Moll, that a vote of thanks be tendered to the London Press and also to the Technical Press for the kind manner in which they reported the proceedings of this convention. Carried.

Moved by Bro. C. Moseley, seconded by Bro. Roberts, that a vote of thanks be tendered to the Mayor, acting Mayor, the President of the Board of Trade, Mr. Baker, Mr. F. Leonard, Col. Gartshore and the Chief of the Fire Department for the kindness shown towards the delegates at this convention. Carried.

Moved by Bro. E. J. Taylor, seconded by Bro. W. H. Bradt, that we tender our thanks to the Exhibitors' Association and to London No. 30 for the royal manner in which they treated the visitors to this convention. Carried.

### Instalation of Officers.

The newly appointed officers were installed by Bro. C. Moseley with the assistance of Bro. E. Grandbois.

The Past President's jewel was presented to Bro. W. C. McGhie, by Bro. A. M. Wickens. Bro. McGhie replied very graciously and was proud to be in a position to be honored with such a mark of favor.

Moved by Bro. C. Moseley, seconded by Bro. G. Moll, that a vote of thanks be tendered to the ladies for the interest which they have taken in the proceedings. Carried.

Moved by Bro. W. Norris, seconded by Bro. W. E. Archer, that the secretary be instructed to see that two bars be added to the jewel for next year. Carried.

After deciding to hold the next convention at Berlin in 1910 the delegates sang that old familiar song, "For Auld Lang Syne," and "God Save the King," and thus terminated the 1909 convention.

After the business of the convention was over Chief Aitken kindly consented to give a short exhibition run of the fire department for the benefit of the delegates.

The members attending the convention adjourned to the corner of Queen's avenue and Wellington Street and sent in a phone alarm. It required the central department one minute and twenty seconds to make the run.

The north and south end halls responded extra qdickly considering the hot weather.

The members of the association were loud in their praise of the department and the quick way that they responded. The firemen also gave an exhibition of hose laying, doing some fast work.

### C. A. S. E. Exhibitors' Association.

The annual meeting of the C.A.S.E. Exhibitors' Association was held on Thursday morning in the city hall. The following officers were elected for the ensuing year :

President, W. R. Stavert, Jenkins Bros., Montreal.

First Vice-President, G. E. Fisher, Canadian Fairbanks, London.

Second Vice-President, E. A. Hethrington, Goldie & McCulloch, Galt.

Treasurer, H. C. Austin, Dunlop Tire and Rubber Goods Co., Toronto.

Secretary, J. B. Goff, Dart Union Co., Toronto.

Assistant-Secretary, G. C. Keith, editor The Power House, Toronto.

The executive consists of the above officers.

The report of Treasurer Robinson was read showing a balance on hand of $30.50.

A motion was passed to elect a committee to confer with a committee from the engineers to suggest an arrangement for a stronger representation of the engineers to the different exhibits, and also to ask the engineers to set aside a day for the exhibitors, and to do all in their power for the enlargement of the exhibitions.

This committee consisting of Messrs. W. R. Stavert, D. O. McKinnon and E. A. Hethrington met with the C.A.S.E. and it was decided to set apart a day devoted to the reading and discussion of engineering papers.

A vote of thanks was passed to W. Norris for the interest that he had taken in the supply association, and a vote was passed to G. E. Fisher, to be extended to the motor boat owners for their kindness in conveying the engineers to Springbank in their motor boats. A vote of thanks was also passed to Messrs. Stavert, Austin and other officers for their work in connection with the exhibition.

It was moved and carried that a five dollar gold piece be taken from the funds of the association and placed to the credit of Baby Austin who was born Tuesday, July 27. Mr. Austin has been Secretary of the Association and this year was elected Treasurer. The gift to his boy was a recognition of his services in connection with the convention.

### The Exhibits.

V. D. ANDERSON CO., Cleveland, Ohio, represented by L. H. Rumage, 1213 Michigan St., Buffalo. Demonstrations were given of the Anderson traps, the feature of the new traps being the facility with which they are changed from low to high pressure and vice versa.

DUNLOP RUBBER GOODS CO., Toronto, represented by H. C. Austin. They had no exhibit but a large sign gave a list of goods manufactured by them.

GOLDIE & McCULLOCH, Galt, Ont., represented by E. F. Hetherington, who distributed catalogues and circular matter in reference to condensers, ideal heaters, heavy duty Corliss engines, Wheelock engines, gas producers, etc. Mr. Hetherington distributed a very acceptable souvenir in the shape of a leather purse.

BICE REGULATOR CO., 121 Dundas St., London, represented by Mr. Bice. The Bice automatic feed and belt or steam pump regulators were exhibited.

QUAKER CITY RUBBER CO., 629 Market St., Philadelphia, represented by Theo. A. Meyers, 207 Wood St., Pittsburg. Samples of "Perfect Piston Packing" were distributed as well as Ebonite packing. Other lines on exhibition were steam hose, marine piston packing, pump valves and many lines of rubber goods. Catalogues were distributed illustrating and describing the various lines.

PEILER & McKENZIE, Montreal, represented by H. L. Peiler, Montreal and F. A. Morrison, of the Mason Regulator Co., Boston. On exhibition were Mason regulators, Ashton valves, Reilly multicoil heater, Berry feed-water control, whistles, steam gages, etc. A self lubricator for engine glands was also shown. This is the invention of V. A. Emond.

I. C. S. CORRESPONDENCE SCHOOLS, Scranton, Pa., represented by Wm. Bowers, London.

DIAMOND GRATE BAR CO., Berlin, represented by J. E. Taylor, Toronto. Grate bars illustrating the construction and operation of the Diamond Grate Bar were shown.

CANADA STEAM BOILER AND EQUIPMENT CO., Toronto, represented by Z. Hemphill. A model of the cyclone grate was shown, also vacuum valves, and standard globe and angle valves.

CANADIAN MANUFACTURER, Toronto, represented by D. O. McKinnon and J. C. Armer, B.Sc.

THE POWER HOUSE, Toronto, represented by H. V. Tyrrell, G. C. Keith, B.Sc., and A. Wales.

AUTOMATIC FEED AND REGULATOR CO., 117 Masonic Temple London, represented by W. R. Colby. This regulator is automatic in operation, and is easily connected to water columns.

McLEOD & HENRY, Troy, N.Y., represented by A. W. Pettie. Models of boiler settings

were shown, consisting of boiler door arch, fire box blocks, etc., as made from "Steel mixture material." Steel mixture will not fuse until 4,000 degrees is reached and has a crushing strength of 5,000 lbs. per sq. in. A souvenir "make a noise like steel mixture," made itself heard during the convention.

RUSSELL & GIFFORD, Montreal and Toronto, represented by P. F. Gifford, Montreal. Bundy traps were shown in sizes and the workings were explained to engineers. A wing turbine blower also formed part of their exhibit.

JENKINS BROS., LTD., Montreal, represented by W. R. Stavert and H. H. Cato, Montreal. They had on exhibition a line of globe, check and angle valves (flanged and screw), hard discs for steam and soft for water and air, and "96" packing. The new type "K" gate valve received considerable favorable attention.

PHILIP CAREY MFG. CO., 112 Bay St., Toronto. O. A. Cole, A. W. Carmichael and H. E. Rowell. On exhibit were pipe coverings of all kinds for high and low pressure steam, hat and cold water, brine, etc. Included were 85 per cent. magnesia covering for high pressure and air cell coverings.

DART UNION CO., 93-97 Niagara St., Toronto, represented by J. B. Goff. A full line of unions and couplings were shown, and flanges in sizes from 2" to 6". These latter caused a great deal of interest among engineers being something new in the steam specialty line.

DEARBORN DRUG & CHEMICAL CO., Chicago, represented by Joseph N. Gregory, 302 Morgan Bldg., Buffalo. Catalogues and circular matter were distributed describing Dearborn corrosion compound, the treatment of boiler feedwaters and lubricants.

LUNKENHEIMER CO., Cincinnati, represented by E. A. Wilkinson, Toronto. The exhibit included valves, whistles, water gages, injectors, oil and grease cups, lubricators, blow-offs and "Marvel" single-feed mechanical oil pump. The "Renewa" valves with renewable seat and disc received considerable attention.

CANADIAN FAIRBANKS, Montreal, represented by Geo. E. Fisher, London and Ff G. Robinson, Toronto. Engineers' and power house supplies were shown including globe, gate and and check valves, Burke oil filter and exhaust head, Foster reducing valves and pump governors, etc. A Fairbanks-Morse boiler feed pump was shown in section.

CLING SURFACE CO., Buffalo, represented by A. J. Gormley. Circulars were distributed showing where Cling Surface is used. The illustrations included Southam Printing & Litho. Co., London.

ENGINEERING JOURNAL, Toronto, represented by H. M. Niosdell, B.A.Sc.

### Condensers.

The London Convention was a big success.

Berlin 1910.

The weather man smiled on London during the convention and all enjoyed themselves.

The new name for the C.A.S.E. Exhibitors' Association is the "bucket brigade."

They say that "Wilkey" has a cast iron constitution but outside of that he's all right.

As a boat containing a number of more than average weight exhibitors neared the wharf a nervous passenger was heard to remark, "Don't all get off at the same side."

Robt. Simmie, chief engineer at Springbank pumping station, treated the visitors to cigars and they were much appreciated.

A visitor wanted to know if that sulphur spring water at Springbank ran over bad eggs to give it its taste.

The baseball game was a good one but Umpire Clark was too honest. Wilkie was a good runner but couldn't get past third and umpire had to call him out. Good work!

En route to the Kennels a passenger cheerfully remarked that we were all going to the dogs. It was noted that the car number was 23.

The tag "Ship me to Berlin C.A.S.E. Convention 1910" did the trick and next year the engineers go to Berlin.

That the interests of the manufacturer and engineer are identical was shown by Mr. Leonard's paper and by the joining of forces, the C.A.S.E. and the C.A.S.E. Exhibitors' Association, to make the convention at Berlin 1910 the best ever. It was a move in the right direction.

"Car" is longing for another visit to London Asylum. I wonder why?

President Kelly's services are to be recognized by a double bar on the past president's jewel.

The souvenir was the result of faithful work on the part of W. Norris. It reflects credit both on Mr. Norris and the London Lodge, of which he is a member.

The souvenirs of the city of London presented by S. Baker, city clerk, were much appreciated by the engineers. It pointed out the beauties and commercial side of "the strategic centre of Western Ontario."

The recognition of Executive Secretary Crockett's services by a C.A.S.E. jewel met with general approval.

---

# Uniform Construction and Inspection of Boilers*

## Paper giving Existing Conditions and what is Being Done to Secure Uniform Construction and Inspection of Steam Boilers.

By F. E. LEONARD

It is very seldom that we look to the west for inaugurating new governing laws, but we boiler manufacturers had to in 1902, for we were confronted by the plucky Province of British Columbia, with a construction and inspection act covering steam boilers. The act is well based on British Board of Trade rules, which are the standard of the world over. France, United States and our Dominion Steamboat Act follow its lines very closely. This province made the first step toward a good boiler, only being put into service and handled by licensed employes. For a couple of years not much attention was paid to it, but recently makers and users have had to live up to it, to the very letter. Personally I doubt the present wisdom of such an act being put into force, before the natural resources of a new province are better developed. The older provinces of Ontario and Quebec have done the right thing in not putting any restrictions on industrial development, and I do not think they have suffered for I believe that there have been less accidents to boilers in proportion to population than any province or state in the world, thanks to the honesty in construction and the care exercised by users in the past years. However, we must be in the front ranks in every respect with any country if we are to be a nation, and it is best for all to give the right hand to any improvement.

### Some Comparisons.

One salient point I want to draw your attention to in particular is, that those local inspectors have the power to take the pressure off of any boiler and lock the safety valve at what they like without the chance of an appeal of any kind. This is not right. We do not even give this power to the judges in our courts. In addition to British Columbia, Alberta has passed a similar act. Saskatchewan is preparing another, and Manitoba is thinking of doing the same. So far, so good, but what we find very confusing is that they differ in details. Permit me to make a few comparisons. One province will allow the standard reinforced manhole in the shell, while another calls for the flanged-in or eclipse pattern, and that with a cast steel cover. One province will take a cast iron steam nozzle, but the other wants cast steel for the same purpose. One wants flanged safety valves and the other will take them screwed into the boiler.

One insists on all openings being reinforced over 1 inch, while Alberta wants all over $1\frac{1}{4}$ inch. Handholes over a certain size ($2\frac{1}{2}$ x $3\frac{1}{2}$ inches), are hereafter to be re-inforced with an additional plate around it in one province but need not in another. One province will allow the safety valves to be blown off from the top, but it's neighbor insists on a side outlet. Now, what about supports? One province will allow no cast iron brackets whatever, but boilers must be suspended from steel channels at least at four points, but not so in another province. The laws of expansion are different across the provincial line I suppose. You can leave brackets at both sides at one end but hangers and steel channels at the other end. One province wants the manhole in all boilers 66 inches and over in the back head above the tubes instead of in the shell as allowed in other provinces. One province wants re-inforcing plates under the wheel brackets of locomotive boilers while the other is not so particular.

* Paper read before the annual convention of the Canadian Association of Stationary Engineers, London, July, 1909.

One province wants handholes on the water-line of upright boilers. One province says the fire-box of an upright boiler must be staybolted as a flat surface if over 18 inches in diameter, while the other will allow something for the strength of the box itself. One province said no radial stays should be used on the crowns of locomotive boilers, and the girder stays would be insisted on. The other allowed the use of radial stays.

By the time each of the nine provinces made laws to suit themselves, from the Pacific to the Atlantic, it would result in the worst confoundation possible. It is altogether likely that uniformity can be brought about in Ontario, Quebec and the three Maritime Provinces without much trouble, but the real hindrance will be to bring the western provinces to think so.

### Uniform Law Necessary.

The engine and boiler section of the Canadian Manufacturers' Association want a uniform boiler construction and inspection law. They are now compiling rules and regulations that they consider would be reasonable to the owner and just to the public. The Canadian Manufacturers Association at their Montreal Convention passed a unanimous resolution endorsing such a law, and will give it every assistance. They are the largest steam users in the Dominion, and if you, gentlemen, who attend in front and around steam boilers, would endorse uniformity, it would help. If such were brought about, it has been suggested that the chief inspectors from each province meet in convention once a year to make changes in rules necessary, hear appeals, and investigate all matters of construction and inspection.

With uniformity, your employer or yourselves would be able then to have made for himself or be able to purchase a boiler in any part of the Dominion and it could be sent and used anywhere from the Atlantic to the Pacific without let or hindrance, if it had a certificate of inspection. If the Dominion is to go on and prosper, we must not allow any hindrance to a free interchange of articles manufactured by ourselves.

Gentlemen, the provincial boiler and other laws are the first steps against our advancement as a united people, we must get all our administrative and commercial affairs as near alike as possible, otherwise, it means disputes with loss of time and money.

We should take lessons from the United States for this battle of uniformity has been going on for over ten years. The State of Michigan has taken a hold of it in a practical way, by instruction, her state and municipal inspectors to meet and talk over the matter of uniformity at the convention of the American Boiler Manufacturers' Association, at Detroit on the 10th and 12th of August. It would be a good thing if you could have your executive attend and lend a hand.

## STRATFORD'S NEW FILTRATION PLANT.

The accompanying illustration shows the mechanical filtration plant at Stratford before the house was built over it. There were two rising mains from the pumphouse, and the tanks are located above and between them, so that feeding the city through either main delivery could be made into the whole or any number of the filtration tanks, or from the whole, or any one tank into either or both of the mains.

Also below ground and not shown in the illustration are straightway by-pass valves permitting the water to go through the rising mains direct from pump to city, if any part of the filtration equipment should be accidentally out of order, when the demand came for a large supply of water to fight fire with. However, the tanks are designed for and have properly purified at the rate of a million and a half gallons per day.

In operation the unfiltered water enters the tanks by the high level cast iron pipes and the filtered water exits into either or both the mains by way of the low level pipes just above the floor. And when washing out the dirt escapes to the drains down by the upright pipes to the right hand of each tank, these upright drain pipes are cut off short of the floor some six or eight inches and deliver into open funnels or hoppers leading direct to the tile sewer, so that the condition (color) of this escaping effluent is under the eye of the man controlling the wash-out valves.

There is a depth of 3½ feet of filtering material used in each tank, crushed quartz, varying from about 5-16 to ⅜ cubes at bottom to quite fine sand at top, and this material re-arranges itself in proper position, and without measurable waste of sand, if the washing-out back pressure is now allowed to go over 40 pounds.

As is common with all mechanical filtration, a small amount of one of the many forms of alum is used to deposit a flocculent coating on the top of the fine sand, forming one of the best of filtering mediums.

This material is dissolved in an open 2 foot cube box, gravitating into a lower open reservoir or mixer of the same size where its strength (density) can be tested by a hygrometer.

Filtration Plant at Stratford Before Being Housed in.

From thence it graviates to an impulse pump at floor level in pump-house, whose strokes always correspond exactly with those of the main pump so that the supply uniformly varies with the variation of the main pump, and as its delivery is into the main suction pipe this fluid gets well mixed in passing through the pump barrel and valves on its way to the perforated distributing pipes at top inside the tanks.

It is very improbable that the sand under these conditions will get charged with bacteria, but if ever suspicious of such a state it is arranged that the sand will drain, and then full pressure boiler steam be passed upwards through the quartz (in the same way as the wash-out water)

The cost of this whole plant, capable of 150 pounds pressure, with a large white and red brick house, cement foundations and floor and a slate roof was barely $11,000.

# The Utilizing of Garbage in the Production of Power

## Municipal Use of Destructor Plants which Cheapen the Cost of Refuse Disposal by Turning the Refuse into Power.

BY JOHN T. FARMER *

The question of the disposal of the refuse material which is produced in such large quantities under the highly artificial conditions of modern commercial life, is one that becomes increasingly insistent as the density of population is augmented, and as the standards of living of the community become more advanced.

These influences have resulted in a good deal of attention being given to this subject in Europe and more particularly in the British Isles during the last quarter of a century. Just as it has happened that, from peculiar conditions, the development in certain lines has had its inception and greatest development in America, in the matter of refuse disposal the older countries have developed systems and methods of dealing with the problem which are well worthy of some careful study by all who are interested in promoting the general health and comfort, and particularly by those who are entrusted with the care of this department of activity in the public interest.

As population concentrates in villages and towns, the nuisance of decaying garbage, indiscriminately cast aside, sooner or later becomes objectionable. The oldest method of dealing with the problem by communal effort is for the community to provide means for collecting and removing the garbage and depositing it at some point where its presence will not be objectionable. The material is often put to use in filling and reclaiming waste spaces; but even this is not entirely free from objection. The chief agent in the neutralisation of putrefying matter is oxygen, and when this is not afforded, as in the case of refuse dumped in bulk, the time required for complete sterilization is uncertain. In the case of such property being used for building or similar purposes it is usually necessary to do more or less excavating, which exposes the old material. In several cases on record there have been suspicions, and more than suspicions, of epidemics having had their origin in the disturbance of such imperfectly decayed matter.

### Used as a Fertilizer.

Another solution of the problem of disposing of the refuse which has been tried is that of utilising it as manure on agricultural lands. Its value in this direction is decreased by the fact that ordinary town refuse contains a considerable proportion of elements which are of no value for this purpose. A report dealing with this point, which may be taken as typical, was made by the Borough Engineer of West Hartlepool, in which he said that practical farmers were coming to the conclusion that ordinary town refuse had not sufficient manurial value to pay the cost of cartage from the town depot. The result of the experience in this particular case was that the council ultimately decided to increase the plant for burning their refuse so as to deal with the whole of it instead of about half which they had been burning up to that time. During the period that both methods were in use simultaneously the results showed that it was more economical to burn the material than to convey it the necessary distance to dump it.

The practical consideration is the cost of dealing with the garbage in this way. In the natural course of things, the spaces available for dumping refuse are more or less removed from the centres of population, and the cost of cartage on account of the long haul becomes quite a serious item. This was strikingly exhibited in the experience of the city of Hamburg, where after five years experience of burning the city refuse the cost of that operation, including fixed charges for repayment of capital and interest, was given as equivalent to 70 cents per net ton, whereas the cost of conveying the garbage to depots in the country districts was estimated at equivalent to 74 cents per net ton.

As showing the trend of the most advanced public opinion on these matters, it is on record that within recent years two towns in England, Bury St. Edmunds and Portsmouth, seeking sanction to borrow money for the purchase of land on which to dump refuse, were advised by the local government board that the board did not approve of this practice, and the permission to float the loans was in each case refused.

### Destroying by Fire.

The use of fire in disposing of this material was first resorted to about the early eighties, when cells or furnaces designed to burn up such matter were introdueed.

The subjection to a heat sufficient to cause combustion, affords a fortunate solution of the problem if it can be carried out as intended, without undue difficulty or expense. The material classed as garbage, is, as regards a large proportion of its constituents, of a combustible nature, that is to say, under the application of a high temperature in the presence of oxygen, the matter is resolved into elemental forms, a large proportion of which, go off in the form of gases, either separate or in combination with oxygen. Further the effect of the high temperature is to kill off any germs existing in the matter where decomposition has set in.

The earliest attempts to carry out the process of burning refuse seem to have been along the line of using a combustible to obtain a fire in which the combustible parts of the refuse were consumed, much as such material might be thrown into any ordinary furnace to be got rid of. It was realized, however, that the refuse itself contained a considerable proportion of combustible matter which should enable it to maintain its own combustion independent of outside assistance, providing the conditions were right. The first successful attempt to put this into practice was the furnace or cell designed by Mr. Alf. Fryer.

In order to maintain the combustion of any substance, the essential condition is that the heat which is dissipated while combustion is going on, must be counterbalanced by the heat generated by the combustion, and to such an extent that the general temperature may be kept above a certain minimum point, below which combustion will not take place with ordinary substances which are recognised as combustibles, such as wood, coal, etc. Once combustion is set up, as a rule the production of heat is sufficient to more than make up the loss which would take place at the minimum temperature necessary for combustion, the result being that the temperature is raised up to and maintained at a higher point. Under these conditions combustion continues as long as fresh material is supplied. The case is different with a substance that does not readily burn. Take as an example wet hay. Suppose that by some outside application of heat it is heated up to a point which causes it to start to burn and then the outside source of heat is withdrawn. The com-

* Mechanical and Hydraulic Consulting Engineer, Montreal.

bustion continues for a time, but during the process the material is being cooled by the contact of the large amount of air circulating through the loosely packed material and also by reason of the amount of heat that is required to evaporate the moisture before combustion can take place. This means a more rapid abstraction of heat than the combustion can make up, the consequence being that the burning material becomes cooler and cooler, until its temperature drops to a point where its particles no longer have a tendency to enter into chemical combination with the oxygen in the air, when combustion ceases.

### Improved Methods.

In seeking for a method of improving the conditions of burning of such a material two courses suggest themselves. One is to supply heat at a greater rate and the other is to cut down the rate of cooling. The first is obviously impracticable without supplying heat from an outside source, as the amount of heat generated by the combustion of any given substance is a certain definite quantity. The rate of dissipation of heat, on the other hand is capable of being reduced, and this may be done mainly in two ways. Firstly, by surrounding the grate or hearth with a casing of heat-resisting material sueg as firebrick, the heat which would otherwise be freely radiated into space is caught, and acts to heat up the material of the casing. As the casing becomes hotter, less radiation takes place towards it from the fire and the temperature in the fire is increased. Secondly, a large amount of cooling may be due to the circulating through and around the burning material of a large body of air, more than is actually required for combustion. The remedy for this is to reduce the quantity of air admitted to the furnace as nearly as practicable to that theoretically required for combustion. These are the two ends sought in designing a furnace for the combustion of garbage. The carrying of the idea into practice is a matter of attention to detail in design. The conditions of working of the highly heated furnace are necessarily very exacting, and care is necessary both in selection of the material, and in the structural formation, so that the furnaces may be subject to a minimum of deterioration. Also experience is of great assistance as a guide in planning the general features, such as the most convenient disposition of the necessary openings for charging the furnace, for removing the residue and the most effective arrangement of the ducts for admitting air and carrying off the products of combustion.

### Using Air Blast.

After some trial of furnaces laid out on the lines indicated, it became apparent that although combustion could be maintained, it was often not as thorough and complete as could be desired, with the result that some of the material would be found to have been charred rather than thoroughly consumed. The next important step therefore was that introduced by Wm. Horsfall, of Leeds, who adopted a forced blast of air to increase the rapidity of combustion and thus attain a higher temperature in the furnace. This principle was rapidly adopted by other makers, and more efficient furnaces so equipped are known as high temperature furnaces, in contradistinction to the type in which natural draft is relied upon. The intense heat resulting from a properly regulated blast results in portions of the material being raised to a temperature of fusion during the process of combustion, so that the whole residue becomes fused in large masses, similar to the clinker formed in coal-burning by the presence of sulphur and other impurities in the coal, and this resulting residue is generally known as clinker. It is very different in texture from the residue found in a low temperature furnace, in which the original texture of the material can frequently be easily traced, though the material itself is of course considerably modified by the action of the fire ; but not so completely sometimes as to be entirely free from elements capable of further decomposition, and therefore to some extent offensive. A thoroughly burnt clinker on the other hand contains only the inorganic residue of the original garbage, in bulk usually from 25 to 33 per cent. of the original, and compacted together so that it forms a substance for which many users are found. Chief among these is its use as an aggregate in concrete. In many towns a large portion of the clinker produced is devoted to the manufacture of concrete blocks and paving slabs and to the laying of cement sidewalks. The clinker is also used for various forms of concrete construction even, as at Liverpool, in the construction of dwelling houses. It is also useful for filter beds.

It need hardly be pointed out that such developments which give some commercial value to the clinker are to be welcomed, as all tending to offset the considerable expense of disposing of garbage. If the resulting clinker, instead of entailing a certain charge per ton for removal, brings a certain price as it lies in the yard, there is a two fold gain.

### Pre-Heating Air Blast.

A further improvement in the way of producing higher temperatures in the furnace and hence of increasing the effectiveness of the combustion, was that of pre-heating the blast of air entering the furnace. This is now very generally done to a greater or less extent. Some destructor plants are equipped with quite elaborate regenerators for heating up the entering air by means of the heated products of combustion given off by the combustion.

After it had been established that it was thoroughly practicable to arrange for garbage to consume itself, by virtue of its inherent combustion value, it became apparent that the products of combustion contained a large amount of heat, and the question arose as to whether this heat could not be conserved and put to commercial use. It is now the usual practice in destructor plants of any magnitude to combine one or more boilers with the destructors, so that the heat generated is utilized in the production of steam. Thus the heat energy of the garbage is transformed into a convenient form for utilization and the value of the energy so conserved, may be arrived at by equating it to the cost of producing a similar amount of steam by ordinary methods of burning ordinary fuel in a standard steam generating plant.

As compared with the results obtained from a similar amount of coal, the quantity of steam generated from a given quantity of garbage is somewhat disappointing. This is not surprising, however, when the compositions of the two substances are compared. The coal, except for a small percentage of incombustible matter, consists entirely of carbon and hydrogen in a condition ready to combine with the atmospheric oxygen with evolution of heat. The garbage, on the other hand, in the first place contains a large proportion of incombustible matter, usually running from 25 to 33 per cent. Of the remainder, a considerable amount is of the nature of organic substances containing a greater or less amount of oxygen in combination, the effect of which is to reduce the amount of atmospheric oxygen necessary for combustion and the net amount of heat generated. A further important point is that the garbage contains a large amount of moisture, both in chemical combination in the organic substances and also in mechanical suspension. Such water has to be driven off and the part of the heat of combustion employed in this way is evidently not available for outside application. The net result of the combustion is the production of gases at a considerably lower temperature than those resulting from the combustion of coal. The result of the lower temperature is that the heat is less readily transferred ; in other words with a given amount of boiler heating surface, a less quantity of steam will be produced from a quantity of garbage giving forth the same number of heat units as a given quantity of esal.

**Amount of Steam Produced.**

The combustion of one pound of garbage can generally be depended upon to produce one pound of steam. Actual results from a number of cases show figures varying from 1 to 1¾ lbs. The evaporation obtainable from one pound of coal varies from 8 to 10 pounds, so that the value of garbage for steam raising purposes may be put down as 1-6 to 1-7 that of average coal. The steam raising effect, of course, varies somewhat according to the nature of the material dealt with in different cases. The accompaning table gives the observed results in a number of installations, these results being deduced from working tests extending over a period of 24 hours to 14 days.

| | Refuse in 24 hours. | Evaporation per lb. | Horse Power from refuse. |
|---|---|---|---|
| Pembroke (Co. Dublin) | 18 tons | 1.21 lb. | 84 Elec. Sta. |
| Stockton-on-Tees | 23 " | 1.22 lb. | 109 |
| Salisbury | 25 " | 1.23 lb. | 115 (Sewerage) |
| Manchester (Moss side) | 60 " | 1.25 lb. | 336 (Baths, etc.) |
| Bradford (Sunbridge Rd.) | 119 " | 1.25 lb. | 652 |
| Luton | 30 " | 1.28 lb. | 180 (Sewerage) |
| Dunoon | 24 " | 1.33 lb. | 118 |
| Beckenham | 32 " | 1.34 lb. | 191 (Elec. Sta.) |
| Accrington | 60 " | 1.39 lb. | 308 (Elec. Sta.) |
| Huddersfield | 31 " | 1.42 lb. | 189 (Sewerage) |
| Fulham, London, S.W. | 131 " | 1.53 lb. | 680 (Elec Sta.) |
| Batley | 33 " | 1.60 lb. | 203 (Elec. Sta.) |
| West Hartlepool | 120 " | 1.61 lb. | 650 (Elec. Sta.) |

It will be noticed that in the majority of the cases cited, the heat obtained from the refuse is utilized in generating electricity. In these cases the destructor usually forms a part of a generating station operated by the municipality. It is not to be assumed that it would be a commercial proposition to go round and collect garbage for the sake of using it as fuel for electric generation or other power purposes; but when it is recognized that the most desirable way to dispose of the refuse is by burning it, then the revenue obtainable in this way affords a very appreciable offset to the cost of such disposal.

**Cost of Plant.**

The actual labor cost in operating a destructor plant, from the results given for various plants in Great Britain runs from 15 to 25 cents per ton of refuse burnt. The labor cost can be reduced by elaborating the apparatus for handling the material, which means an increase in the fixed charges, which may or may not offset the saving in labor cost. For Canadian conditions the labor cost would naturally be expected to be increased, probably by about 50 p.c. on account of the higher cost of labor.

The fixed charges on a plant are more difficult to state definitely, as the situation and conditions vary so much for different plants, that the investment called for to provide a given capacity is a very variable quantity. In a general way, however, a fixed charge about equal to the amount stated for labor would appear to be a fair approximation.

If both labor and fixed charges were charged against the boiler plant for the heat supplied, this would amount to a charge of about 60 cents per ton of refuse burnt. To provide the heat by burning coal would require the combustion of say, 1-7 of a ton of coal at a cost varying in different localities, but running in Eastern Canada about 45 to 50 cents. To this should be added the cost of handling and firing in the boiler house, handling the ashes, etc., all of which would be obviated if the heat from the refuse destructor were used.

From these considerations it will be seen that though there may be no decided economy in using the heat from a destructor in place of burning coal directly, still the relative costs are so close as practically to meet the cost of destroying the refuse, when such a field of heat utilization is available in connection with a refuse disposal scheme.

Space will hardly permit of entering into detail with regard to the various elaborations which have been adopted in connection with destructors. These have been largely in connection with the storage and handling of the material, to save labor and space, and also, which is an important object, to minimise the possibilities of nuisance. Where the most improved methods have been adopted, as in the installation at Greenock, Scotland, the material is handled throughout without direct manual intervention, and in such a manner that its presence would hardly be detected by anyone unaware of the process being carried on in the building.

This is recognized to be an important consideration, if only for the health and well-being of those employed around the destructor. Another consideration of more widespread import, is that there should be no disagreeable trace, in the surrounding atmosphere, of the large bulk of the material which is dissipated in the form of gases through the chimney. The possibility of this is obviated to a large extent by the employment of high temperature furnaces, as described earlier. During the combustion of any material containing a large percentage of gas forming substance, and particularly during the earlier stages of the combustion, there is an energetic distillation of hydro-carbons, which if not subsequently burned to carbon di-oxide and water, would form objectionable traces in the surrounding atmosphere. The higher the temperature of the cell is maintained and the better regulated the combustion the more completely these gases will be reduced to the ultimate forms, which are easily taken care of by processes of nature going on in the atmosphere. Another possibility of objection is from the finer particles of solid matter, which may be mechanically carried forth with the escaping chimney gases and spread broadcast. The most approved device for removing this objection consists of a dust-catcher of a centrifugal pattern, on the principle of those employed in shaving exhaust systems to catch the shavings and chips carried along by the draft of air. That these sources of objection can be, and are effectually removed, is abundantly testified by residents and neighbors in close proximity to numerous plants in constant operation.

In conclusion, it is interesting to note the remarks of such authorities as Lord Kelvin and Prof. Archibald Barr of Glasgow University, in a joint report made by them after an examination of a number of destructor plants in operation. Omitting minor detailed references, they say :

"We would say at once that we are convinced that the system is a thoroughly good one, and that it embodies features which would lead us to expect unusually satisfactory results. We would instance the special arrangements that are made for the maintenance of a high temperature as being a feature of great importance, alike from the point of view of the complete destruction of all noxious or deleterious matter, and for rendering feasible the economic utilization of the heat produced.

"We are convinced that properly constructed plants cause no inconvenience whatever. The absence of smoke is such as is attained in exceedingly few, if in any, power plants using coal as fuel, while the complete destruction of organic matter is secured by the provisions above described. Destructors of this type may be located in populous

districts without menace to health or comfort. The expense of cartage may thus be reduced to a minimum, and further, the inconvenience which must arise if all the refuse from a large district is taken along one thoroughfare to a destructor in the outskirts may be avoided."

## LEATHER BELTING FOR TRANSMISSION OF POWER.

By Harrington Emerson.*

If any industrial plant does not recognize the importance of high-grade instalations of all kinds, a constant care over them and best maintenance, if it is to be a slipshod, happy-go-lucky plant (many plants are of this character), then it is better to instal belting and stick to it, as it will stand more ignorance, abuse and neglect than any other instalation.

One of the fundamental peculiarities of leather belting is elasticity. If belting were not elastic, could not stretch, it would lose most of its value as a transmitter of power. It fills the same purpose between shaft and tool that a pneumatic tire does between road and automobile or bicycle. It absorbs shock that otherwise would cause smashing and breaking, but it does more than this. If the strain becomes too great, the belt either slips or in the worst case breaks. In either case repairs are promptly made with minimum expense.

The inclination to change length under load or when the weather changes is the cause of all the legitimate wear on belts; it is the main difficulty in the way of correct operation and maintenance. A great majority of belt instalations do not admit of adjustable pulleys, adjustable shafts, nor tightener pulleys by which the belt tension can be regulated. In the shops of the Santa Fe Railroad a method has been evolved which permits tightening belts, which could not be made endless, with very little trouble and delay. When first put on the belt was cut 6 inches short, and a 6-inch piece was used to fill the gap. This insert was connected at both ends to the belt by rawhide lacing or spiral wire hinge. At the end of a few hours the 6-inch piece was taken out, returned to the belt room and a 5-inch piece inserted. This change required a very short time. At the end of a day a 4-inch piece replaced the 5-inch piece, and as the belt gradually lengthened, shorter and shorter insert pieces were put in, thus at all times adjusting the tension to climatic and service conditions.

The whole of correct belting operation can be summed up in a very few principles. There should be allowed 1080 feet per minute of double belt, 1 inch wide, per horse-power. The lowest initial tension should be used under which the belt will pull without slip.**

A tension of 35 pounds per inch of double belt exclusive of load is sufficient.

The result will be that the creep of the belt should be a minimum and extend through a very small angle on the face of the pulley.

A belt runs to the driving pulley under tension and it runs off the driving pulley slack or under less tension. When under tension the belt stretches. When the tension is lessened it shortens. This shortening must take place on the face of the driving pulley. The stretch must take place on the face of the driven pulley. As a consequence the belt creeps against the direction of its running on the driving pulley and creeps in the direction of the running on the driven pulley.

If the load is heavy, the stretch is great and the creep is great. If the load is light the creep is small. If the hug of the belt to the pulley is close, the creep, whether great or little, is through a small angle. If the hug of belt to pulley is poor, the creep, whether great or little, is through a large angle. To insure, therefore, a minimum creep through a small angle the load should be light and the hug close.

Oak-tanned and fulled belts last longer, cause fewer interruptions to manufacture, stretch more evenly, cost less per year of service, require tightening less often and give less trouble when first started than others.

The less the normal load the more elastic the belt can be.

The number of lineal feet of double belt, 1 inch wide, passing around a pulley per minute, to transmit 1 horse-power is about 450 feet.

The belt speed for maximum economy is between 4,000 to 4,500 feet per minute, but for main-drive belts it can be considerably higher.

Leather belts are more durable and work more satisfactorily when made narrow and thick, rather than wide and thin. The best plan is to use single leather belts on pulleys less than 12 inches in diameter, double belts on pulleys less than 20 inches in diameter, and triple belts on pulleys less than 30 inches in diameter.

The ends of belts should be either spliced or cemented or be joined by removable insert pieces, which may be either laced with rawhide or united by spiral wire hinge with removable rawhide pin.

Belts should be kept clean, soft and pliable.

Belts should be continually inspected so as to repair weaknesses and prevent breakdowns.

Pulleys should be 25 per cent. wider than the belts running on them.

They should be very smooth, very slightly crowned, if at all, it being essential that the crowning be absolutely central; the pulleys must be perfectly round, run true and be in perfect alignment.

Belts of any width can be successfully shifted backward and forward on tight and loose pulleys. Belts running 6,000 feet a minute and driving 300 horse-power, are daily shifted on tight and loose pulleys to throw lines of shafting in and out of use.

Shifting pulleys are preferable to cut-off couplings or friction clutch pulleys for throwing heavy lines of shafting in and out of use.

To provide some means of taking up the recurring slack, all the poor methods of belt fastening came into use, the English overlap, brass studs, riveted hinges, claws, unnecessarily large holes for rawhide lacing. To prevent the excessive creep and slip, all sorts of belt dopes came into use, from powdered resin up, and the maintenance and care of the belts were generally entrusted to the mechanic in charge of the machine.

A perfectly clean, soft hand will not slip easily even on smooth glass or polished wood. Leather was once skin, and soft clean leather will not slip easily on a smooth, bright pulley surface.

A belt ought to slip if the strain is too great. Keep the load down by making the belt large enough, let the hug be close, and there will be very little creep, or slip or wear.

* Abstract from Paper Read Before the Leather Belting Manufacturers' Association.

** This rule is not applicable to heavy main-drive belts. "Kent's Pocket Book," page 882, gives the reason for this rule. The question is not how narrow a belt can be to transmit a given horsepower, but how wide it must be to transmit the given horsepower with the minimum cost in time and worry and power for reliable operation. A single belt 1 inch wide running 550 feet per minute may transmit a horse-power without immediately breaking, but it will not do it as reliably nor economically as a double belt running 1,000 feet per minute.


### IT BROUGHT RESULTS.

Erie, Pa., August 12, 1909.

Editor of The Power House,
Toronto, Ont.

Dear Sir:—

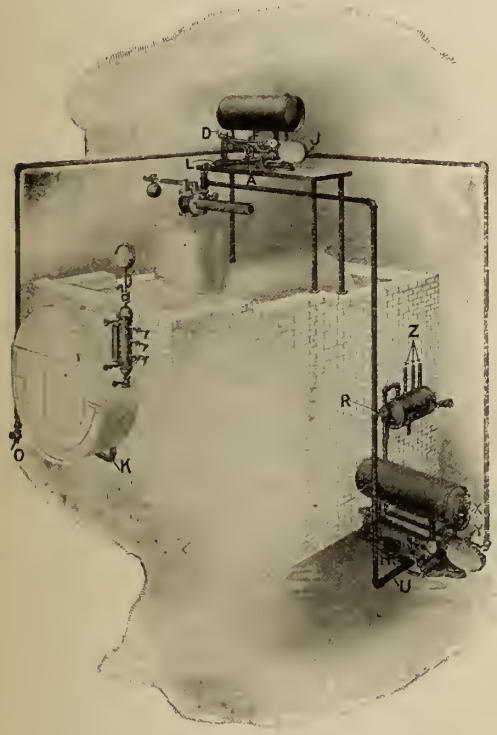
We desire to express our appreciation of the notice which you gave recently in The Power House of the free distribution of an Engineers' Hand Book as published by us, and to advise that we have received a very large number of requests for copies of this issue which is ample to supply all who would be interested in a book of this kind, and we have noted another special feature in connection with enquiries for these books that a very large number of the reciprocants have expressed their appreciation by writing us complimenting the compilation, and we thought this information would be of interest to you, and remain.

Yours truly,
ERIE ENGINE WORKS.
F. L. Cleveland,
Sec'y & Treas.

# Morehead Tilting Return Steam Trap Systems

**Description of Single and Double Trap Systems and their Relation to Heating Systems and Boiler Feeding, with Illustrations.**

As an agent in the economic handling of condensation in steam lines, the feeding of boilers from open heaters, high pressure or low pressure, etc., the modern trap merits the attention of power plant desginers and managers in general, and the engineer in charge in particular.




Instalation of Morehead Double Trap System.

The possible applications and the present uses of the Morehead trap in power and heating fields are as follows:

Feeding boilers from open or closed heaters; return water of condensation from heating systems, dry kilns, kettles, etc., directly to the boilers regardless of the temperature of the water; drain exhaust lines and vacuum oil separators without impairing the vacuum; discharge high or low pressure condensation into a vacuum line; create a vacuum on any exhaust or low pressure heating system or dry kiln, etc., and in every case gives perfect satisfaction, under all conditions of service.

While feeding boilers from an open heater by means of a steam trap may be considered as reaching the stage of common practice, very little, if anything, has been written on the subject, from an economic standpoint, in actual practice.

The following is an interesting statement of conditions existing at the plant of the Stott Mills, Detroit, Mich.:—

The equipment of the plant consists of two 150 H.P. and one 250 H.P. Babcock-Wilcox Water Tube Boilers, and one 500 H.P. Allis-Chalmers Tandem Compound Condensing Engine and one 500 H. P. Monarch Corliss Engine, the condensing engine being used in connection with a Wheeler Surface Condensor, and a Cochrane open type feed water heater.

### Conditions of Operation.

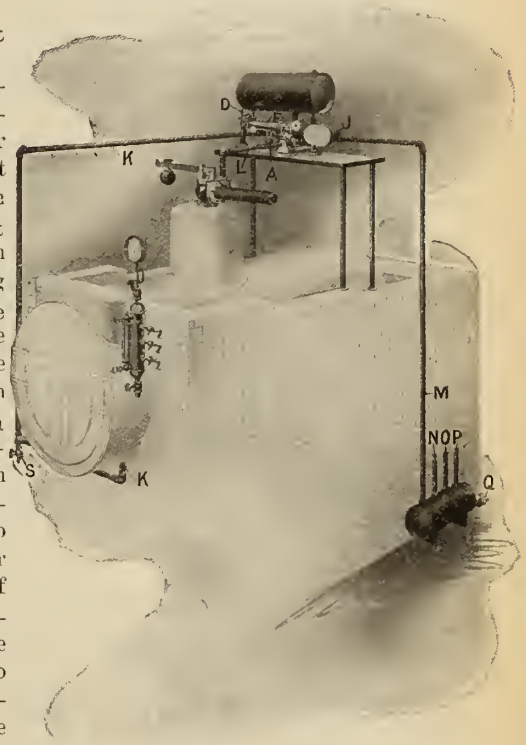
The conditions under which the plant is operated are about as follows:

The entire exhaust from the condensing engine goes, of course, to the condenser; the water from the condenser going to the open feed water heater at about 110 degrees F. The exhaust from the Corliss engine is split, part of it going to the heating system and grain dryer in the mill, and part of it being used for heating the feed water in the heater. In this way you can raise the temperature of the feed water in the heater to from 206 to 208 degrees. From the feed water heater it is carried by a 4-inch main to a 3-inch Morehead Return Steam Trap on the boiler room floor, which acts as a lift pump, delivering the water to another 3-inch trap placed above the boilers. The water leaves the heater at a temperature of from 206 to 208 degrees, and when reaching the boilers (which are fed by the traps through the blow-off) is raised to a temperature of from 255 to 262 degrees; the rise in temperature being due to the action of the traps.

In illustrating the economy of traps, it has been demonstrated that if in above installation we cut off entirely the exhaust from Corliss engine from the heater, and cut out the traps feeding the boilers, using the boiler feed pump, also using the exhaust from the pump to heat the feed water in the heater, the temperature of the feed water will reach to from 208 to 211 degrees, and will be delivered to the boilers by the pumps at that temperature.

Non-Return Tilting Trap Showing Discharge Part of Trap.

If on the other hand we cut out the exhaust from the Corliss engine and shut off the boiler feed pump, and take the exhaust from both the traps back into the feed water heater, the temperature of the feed water heater will drop to from 165 to 168 degrees, this drop in the temperature of the feed water showing the difference in consumption of steam between the two traps and the boiler feed pump.




Instalation of Morehead Single Trap System.

The boilers here referred to are operating under about 140-lb. pressure.

While scientific tests have been made of traps, it is further evident from the fuel bills, that the traps show a very small consumption of coal; that they give little trouble, and cost very little for repairs.

### Description of Trap.

The prominent features of the Morehead trap are their simplicity of construction and the little or no attention required when in service.

The trap consists essentially of a steel tank, the head and logitudinal seams of which are closely riveted and brazed, swung on a brass trunion between two supports secured to a cast-iron bed. The supports consist of the valve connection on the one side and the water on the other side, both of brass, and of such a shape as to form a secure and suitable rest for the trunion.

In the return trap the admission and discharge of the condensation take place at the water end of the trunion while

the valves serve as an admission port for live steam. This valve which serves as a steam admission port for the return trap also provides, at the proper time, a discharge for the contents of the trap. The valve has a removable disc, a desirable feature in steam trap construction.

Leading from the valve casting of the return trap is a weighted automatic relief valve, operated by a link connection from the steam valve lever.

Bolted to the bed plate, in a position just under the ends of the tank, are two upright buffers, which serve to limit the swing of and provide resting points for the trap in its filling and discharge positions.

All valves and working parts are made of hard brass and rendered easily accessible by being located outside. It is significant, that throughout the entire construction of the two styles of traps, there is no possible avenue for the escape or waste of steam.

### Operation.

The principles of operation of the Morehead Return Trap are simple.

The operation of the return trap is the result of a simple obeyance of the law of gravity.

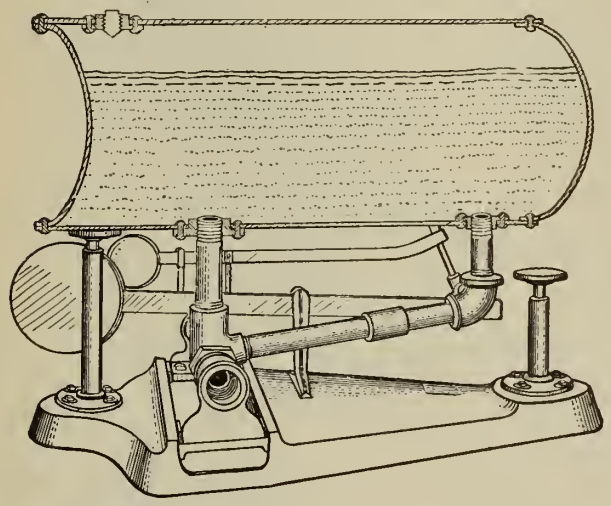
The trap tank, supported by a brass trunion, is maintained normally in a horizontal position by means of weighted lever. When sufficient water has entered the trap to overcome the action of the lever, the tank tilts downward, automatically opening the live steam valve, admitting steam at full boiler pressure above the condensation in the tank. The resulting equalization of pressures in the trap tank and boiler permits the natural flow of water from the trap to the boiler.

The valve provided for relieving the trap tank of all air pressure during the period of filling is automatic in operation and positive in action under all conditions. One of the features of the trap construction is the arrangement of levers operating the valves. The movement of the levers is so graduated that it is impossible for the valves to pound themselves to pieces, or to permit the trap becoming air-bound.

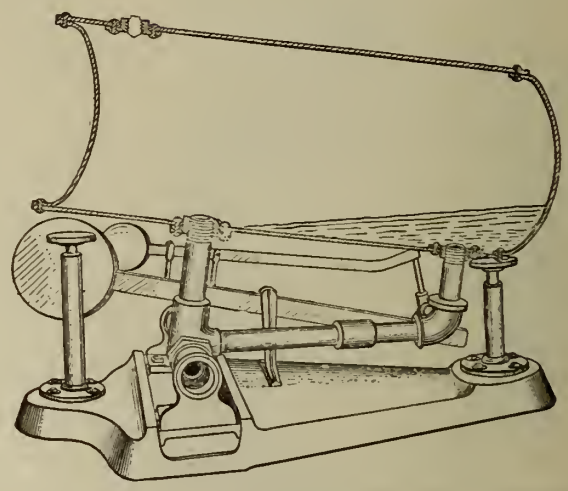
Swing check valves located in the water supply pipe to, and discharge pipe from, the trap prevents, in the former case, the backing up of water into the supply pipe, while the trap is discharging, and in the latter, the boiler pressure from interfering with the filling of the trap.

The adjustment of the weight on the main lever is such that, while allowing for the normal discharge of the contents of the tank it prevents the discharge of that amount necessary for an effective water seal.

The tilting movement with each of the Morehead trap affords an absolute indication of the proper working of the trap. The Morehead trap is manufactured by the Morehead Mfg. Co., Detroit.



Cross Section Showing Water Level at Beginning of Discharge.



Cross Section Morehead Trap Showing Level at End of Discharge.

---

## PERSONAL ITEMS.

K. M. Trigge, who for many years has been a traveler for the Allith Mfg. Co., Hamilton, covering eastern territory, has made a change. He has joined the selling staff of the Reddaway Belting Co., and will cover the States of Vermont, New Hampshire and Maine as well as the asbestos districts of Quebec province and the Maritime Provinces. Mr. Trigge will be familiar with this trade having been with the Reddaway company years formerly. He made many friends in his own field and no doubt will prove an acquisition to his old firm.

Harry A. Moore and John J. Scollan, electrical and mechanical engineers, have opened offices in Toronto, at 43 King Street West. They will act as consulting engineers in steam, electric and hydraulic power, preparing estimates, plans, etc.

O. W. Smith, C.E., of Galt & Smith, Toronto, is in British Columbia on a business trip.

S. H. and D. C. Fellowes have formed a partnership, under the name of Fellowes & Fellowes, with offices in the Lawlor Building, Toronto, and are representing a number of U. S. manufactures of contractors' railway and municipal supplies.

J. A. Shand, of Allis-Chalmers-Bullock, Toronto, has been transferred to the Vancouver offices of this company.

A partnership has been formed between J. F. V. Vandeleur, Mem. Can. Min. Inst., Mem. Chem. & Met. Soc. of South Africa, etc., and R. H. M. Nichols, Assoc A.I.E.E., under the firm name of Vandeleur & Nichols. Mr. Nichols has been sales manager for Mr. Vandeleur for the past year and during that period the business has extended rapidly, necessitating Mr. Vandeleur's presence in Europe to complete shipments of machinery, etc. In his absence Mr. Nichols will be in charge of the office.

Lawford Grant has been elected president and managing director of the recently incorporated Canadian-British Insulated & Helsby Cables Co.

W. N. Dietrich, who has been in charge of the electrical department of the C. P.R., has severed his connection with the company, for the purpose of taking up general consulting and contracting in eelctrical and mechanical engineering. He superintended the instalation of the electrical equipment of the Angus shops, Fort William elevators, and Winnipeg shops, and later designed and installed the equipment, in the Toronto Junction shops, the C.P.R. hotels, and also at various divisional points. He is opening up offices at 16 St. Sacrament Street, Montreal.

# Some Improvements in Suction Gas Producers *

## Gas Producers are Being Improved — This is the Third of a Series, Showing the Good Results Obtainable using Producer Gas for Power

By J. DYMOND **

At the present time regenerative improvements in suction gas producers are being carefully considered by all engineers, as it is well known that some of the suction producers made in the past few years have not been as reliable as one would have desired.

To obviate the difficulties hitherto encountered, a generator has been placed on the market which has attached thereto several very important features, embodying therein, as may be seen by the accompanying illustration, superheating regenerative devices, which make it possible to produce gas of a higher calorific value very economically.

The principle adopted is a double cylinder, one within the other, the inner cylinder being arranged in such a manner that an annular space is formed between this and the outer, having two or more zones with manifolds or specially prepared tubes to connect the zones together, through which pass the air and the moisture from the saturator. After entering the upper superheating zone or chamber, it is drawn across to the opposite side of the producer, then down through the manifolds or tubes to a lower zone, etc., until it reaches the distributor, from there it is conveyed to the fire base, and is then drawn through the incandescent fuel bed. During its permeation upwards therethrough, two reactions take place which may be expressed by :—

$$2C+O_2=2CO$$
$$C+H_2O=CO+H_2.$$

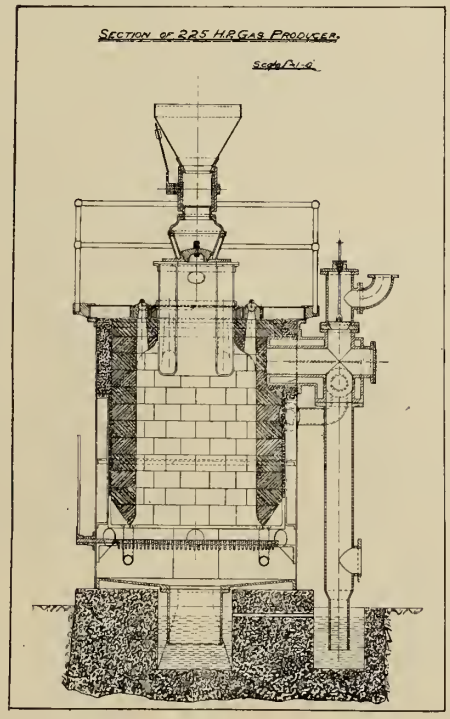
which is to say, that, the oxygen of the air combines with the carbon of the fuel to form carbon monoxide, and, the mixture with more carbon, more of the monoxide, also free hydrogen.

In addition to this, there is also generated a certain amount of marsh gas, $CH_4$, and carbon dioxide, $CH_2$, making the composition of the gas—combustibles CO, $H_2$, and $CH_4$, diluted with non-combustibles, $CO_2$ and $N_2$. The necessary moisture is raised in the saturator by extracting the heat from the escaping gases immediately as it leaves the fire.

The air is also heated by the gases as well, the crown or double head being especially constructed for this object. The mixing of the air and vapour first takes place in the superheating cross prepared for this purpose, from there it is then carried to the top zone in the annular space herebefore referred to.

The saturator is made of Siemens-Martins steel and welded, and is provided with the usual equipment of boiler mountings, and is also filled with a ground joint, therefore making it easy and convenient to remove at any time.

The fire grates are made in four or more sections, each section can be separately rotated, and locked into position when stationary. Six or more fire




Section 225 S.H.P. Producer.

doors are provided, which enable the fire base to be cleared in an easy manner. A sufficient number of poke holes are arranged through the crown and are filled with an improved valve, which is readily removed and replaced without any trouble. The bottom is provided with a dutchman through which all ashes and clinkers can be removed.

The producer is lined with a specially designed fire block. The back or the outside of these bricks being placed closely to the inner cylinder, makes a very hot annular space which, as may be readily understood, partially decomposes or converts the moisture and air into a gas before coming in contact with the incandescent fuel bed. This has the advantage of saving fuel and maintaining a constant and steady supply of good gas, therefore the engine may be relied upon to carry a varying load without any perceptible diminuation of speed.

By the use of this superheating or regenerative arrangement atmospheric or climatic conditions have no influence over the gas-making process.

### Test of Apparatus.

A test of 24 hours has been made on a machine of this description, averaging 100 B.H.P. the result being that the consumption of coal for 24 hours through averaged ⅞ of a lb. per B.H.P. per hour at an altitude of over 1,000 feet above sea-level.

The producer was attended to once in every three hours, the engine's speed did not vary 2 per cent. Such a test as this should be sufficient in itself, to convince the most sceptical, that, as a motive power, gas producers are reliable as a source of power. Plants are being made in sizes from 10 B.H.P. to 500 B.H.P. and patents are being applied for in all parts of the world.

* First article appeared in May and second in July issue of The Power House.

** Mechanical Engineer of Dymond Gas and Engine Co., Toronto.

### ALMOST EQUAL TO PERSONAL ASSOCIATION.

Toronto, July 23, 1909.

Editor The Power House,
Toronto, Ont.

Gentlemen ;—

In your editorial, July number, you have a good word to say for the Associations. Unfortunately many engineers cannot attend those meetings, through different causes. Many men in villages are barred from this advantage, on account of distance from any lodge room ; but I would suggest to men so placed to take a good trade paper like The Power House. It is almost equal to personal association with engineers, for it gives the views of men in engine rooms. They ask questions and are answered in the next number. You get the opinion of not one or a few men, but of many. It is a school of instruction of the very best kind and it is practically free of cost, or about eight cents a month. The practical articles alone are worth many times the cost of the paper to any operating engineer.

JAMES E. NOBLE.

### CANADIAN NATIONAL EXHIBITION

There is always a good display of power machinery and engineers' supplies at the Canadian National Exhibition, Toronto, and this year will be no exception. Many manufacturers have signified their intention of exhibiting, and the prospects are that there will be larger exhibits this year than any previous year. These will include motors, engines, gas producers and power room supplies. All interested in power whether electric, steam, gas, air or water power will find it to their advantage to inspect the many lines that will be shown. The dates are Aug. 28 to Sept. 13.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe 933-935 Monadnock Block
NEW YORK - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone 1111 Cortlandt

**SWITZERLAND**
ZURICH - - Louis Wolf Orell Fussli & Co.

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:
Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II AUGUST, 1909 No. 8

## CONTENTS

Convention of Canadian Association of Stationary Engineers - - - - - 17
Uniform Construction and Inspection of Boilers - - 27
Stratford's New Filtration Plant 28
The Utilizing of Garbage in the Production of Power - - 29
Leather Belting for the Transmission of Power - - - 32
Morehead Tilting Return Steam Trap System - - - - 33
Some Improvements in Suction Gas Producers - - - 35
Canadian National Exhibition - 35
Editorial - - - - - 36
Practical Articles by our Readers 38
- Transforming Coal into Electricity.
- Electrolysis of Water Mains.
- Some Curious Power House Experiences.
- Unique Tilting Trap Installation.
- Smoke Prevention in Steam Boilers.
- Boiler Efficiency.
- Pump Repairs.
- Injector Information.

Correspondence and Discussion on Previous Articles - - 43
- Replies to Questions.
- Case of Boilers.
- How Should the Valves be Set.
- Engine Cards.

New Equipment for Power Plants - - - - - 45
- Peerless V-Belt.
- Starting Panels for D.C. Service.
- High Speed Pump.

Uniform Boiler Law - - - 47
Electrical Plant at North Hatley - - - - - - - 47

### ANNUAL CONVENTION C.A.S.E.

The twentieth annual convention of the Canadian Association of Stationary Engineers, held in London in July was a distinct success. The convention is divided into four divisions, 1 Business, 2 Educational, 3 Manufacturers' exhibits and 4 Social. So far the business and educational have been merged into one, and only the delegates have had the privilege of hearing the interesting papers and addresses given at the convention. Next year all this will be changed. The C. A. S. E. Exhibitors Association and the C. A. S. E. are uniting to make the educational division one of the most prominent features of the association, and all engineers, whether members of the C. A. S. E., or not, will be invited to attend the convention in Berlin next year, listen to the valuable papers which will be provided for, and increase their knowledge by viewing first hand, the new and useful devices that manufacturers are placing on the Canadian market.

Of necessity the business sessions will be closed, except to delegates to facilitate the quick transaction of business, but there will in future be an attraction for every engineer at these annual gatherings, and every engineer will find it to his advantage to attend.

The man has not been born who has a monopoly on ideas, and the reading and discussion of papers will assist in disseminating knowledge and experience so that each succeeding generation will be enabled to advance in their methods and practice.

Another educational feature is the manufacturers' exhibits. The engineer can keep in touch with the newest and best appliances. A visit to the convention allows an examination of the power house equipment, first hand, and suggests ideas for the betterment of present conditions in the power plant. Manufacturers will find it to their advantage to have their engineers attend these conventions in future, listen to and discuss the papers, look over the exhibits and rub shoulders in a social way with other engineers.

In this issue of The Power House appears a full report of the London convention. We have kept in mind those who were not in attendance at the convention, and have given a full report with a number of illustrations. It is to be hoped that there will be a much larger number attend the convention in Berlin next year.

### GRADED CERTIFICATES FOR ONTARIO ENGINEERS.

The Canadian Association of Stationary Engineers discussed the question of graded certificates for Ontario engineers. There are graded certificates in British Columbia, Alberta, Saskatchewan and Nova Scotia. The Manitoba Government has the question of an act respecting engineers before them. It is a copy of the Ontario Act, except that provision is made for graded engineers.

The C. A. S. E. decided to present a petition to the Ontario Government, asking for graded certificates and that it be optional with the engineer whether he obtain the higher certificates or not. There should be some distinction between men in charge of 50 h.p. and 1,000 h.p. plants, and with the Ontario system all engineers are on an equal footing. At the Engineers' Banquet in London, Hon. Adam Beck stated that the Ontario Government was prepared to carry out any legislation that would be for the public good, and all they needed was to be convinced. He thought that the graded certificate was a necessity. It is hoped that when the matter is placed before Hon. Mr. Duff, and his department, that the question of grad-

ed certificates will receive the recognition this important question deserves.

## LOST ENERGY.

"The mill will never grind with the water that has passed." You start out in life with a certain amount of energy; you can use it for teaching, selling goods, engineering, etc. If, however, you fool away your time allowing a multitude of little leaks in your reservoir to drain off your supply, you will be surprised at the small amount of water which runs over the wheel to turn life's machinery,—to actually do life's work.

Therefore do not waste time. And do not put off until to-morrow what can be done to-day. Procrastination is the thief of time. You probably meant to do a little reading and learn a little more about power and power transmission, but you have put it off. Perhaps you feel a little tired after a hard day in the engine room or factory; perhaps you think the evenings are wholly for recreation. Every man needs recreation, but just a little time each evening, turned in the right direction, will surprise you with the progress you can make by its utilization.

If you don't learn to-day, it will be harder to-morrow. To-morrow you may lack the inclination. There is no royal road to learning. You gain knowledge by the expending of energy.

If you are going to be an engineer, be the very best engineer. Do not be content with a certificate. You have life and property in your keeping and you must be ever alert to learn more about your profession. It may some day pay you and give you the opportunity of advancement for which you are looking. Theodore Roosevelt once said: "It is only through labor and painful effort, by grim energy and resolute courage that we move on to better things."

There are many good articles appearing in the technical press at the present time. The technical papers have been alive to the needs of engineers and have endeavored to supply those needs. The opportunity for you to read and study the articles appearing each month is yours now. For you the water is passing over the mill and you may miss an opportunity of learning something that will help you afterwards when difficulties arise in your own power plant. Begin to acquire knowledge now while you have the energy.

## STANDARD BOILER LAW.

On another page is printed a paper read by F. E. Leonard, of E. Leonard & Sons, London, before the Canadian Association of Stationary Engineers, at a luncheon given by him to the engineers. The paper sets forth clearly the condition that exists in Canada. The question of boiler inspection and construction is within the jurisdiction of the provinces and the result is, as we pointed out editorially in our special Boiler Number of "The Power House," in June, that inter-provincial trade is being hampered by the present state of affairs.

The Canadian manufacturers' Association is approaching the proper authorities in each province to have a uniform law enacted by the various provinces. According to the present laws it would appear that the law of statics depended on the boundries of the provinces, but this is not the case. The capacity of material to resist rupture is the same whether used in Nova Scotia, Ontario, Alberta or British Columbia. It is unfortunate that this condition has arisen for it appears to us to be contrary to the British North America Act of 1867. We are sure that if the engineers and manufacturers unite in bringing the matter, which is of importance to both bodies of men, to the proper authorities in the various provinces, the wheels of government will begin revolving in the right direction, and a uniform law will be the result.

## GIVE HIM THE HORSE LAUGH.

If you have anything in your system work it out. Don't be afraid to stand up like a man and tell your boss or the head of your department just how you feel, writes Mike Kenny, in the Gimlet.

But for goodness sake don't sulk—don't pout—don't throw things around—don't pull down the corners of your mouth. Don't get in a dark corner with the other fellow and tell him all about it. That's the way cowards act.

If you are not afraid, if you know your reasons are good, if you know you are right, then you should not hesitate to stand up and give your boss the "striaght goods."

Generally when a fellow sneaks around and mumbles to himself he is in the wrong and he knows it, and when he tells a fellow clerk his side of the story, he does not tell it straight.

May the good Lord deliver us from grouchy people—from the man who beckons to you to come with him under the stairs and then whispers his troubles in your ears.

If there is a man of this kind in your works, when he gives you the secret signal to come into the dark corner, give him the horse laugh. Tell him you live out in the sunshine, where the work is done and where you can do an honest day's work.

## LOOKING AFTER THE WELFARE OF THE MEN.

There are so many companies and corporations who think of men as mere machines that it is a pleasure to note from time to time companies taking an interest in the workmen who toil for the good of their company. In other issues of The Power House we have referred to the provisions for the welfare of the men. In our June issue we referred to the men's rooms in the Hamilton Bridge Works, Hamilton.

The McClary Mfg. Co., London, have also provided rooms for the men. The dining room was opened on Saturday, June 19. It is a fine, airy place, about 100 feet square, where the men are provided with hot water and towels for cleaning their hands, and in addition are provided with tea, coffee and the necessary dishes without cost to themselves. The dishes are thoroughly sterilized after each meal. To the other provisions for the men's welfare are added a large number of current periodicals and playing cards for those who feel so disposed, while those more athletically inclined are provided with a quoiting ground. This move is an effort in the right direction to improve the health conditions of the men.

## PROTECT THE MACHINERY.

Had not the smock worn by an employe of the London Street Railway power house given way, he would have met a terrible death by contact with a four-foot wide belt, recently. As it is, he suffered from a badly crushed chest, bruised arm and body. The point we wish to make is that more time and thought should be given to the protection of belts, pulleys, machinery, etc. The writer has seen men twisted up and get fingers mangled from unprotected machinery. In some works, attention has been given this matter, but there is room in a great many yet, for the instalation of devices to protect the workmen.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## TRANSFORMING COAL INTO ELECTRICITY.

By Live Wire.

I give you below my method of procedure in arriving at the number of pounds of coal required, per hour, to produce the requisite number of heat units for the operation of 600 incandescent lamps, assuming that the process of transforming the heat of the coal into electrical energy is not attended by loss :—

Number of lamps, 600.
Consumption of current, ½ ampere.
Pressure across terminals, 110 volts.

No. of watts=600×110× ½.
No. of B. t. u's. per second=.0009477 ×600 × 110 × ½=34.1172.
No. of B. t. u's. per minute=34.1172 × 60=2047.032.
No. of B. t. u's. per hour=2047.032× 60=122821.92.
No. of lbs. of coal for 600 lamps per hour=$\frac{122821.92}{14,500}$=8.47.

My fireman informs me that he shovels considerably more than 8.47 lbs. of coal every night. It would appear, therefore, if my figuring is correct, that 'boilin' water" is one of the most inefficient systems ever devised for the purpose of artificial illumination. Is there no way of bottling these elusive B.t.u.'s just as soon as they work their way out of the coal, and have them heat the filament direct without employing boilers, engines or dynamos ? As it is at present there is a lot of them getting away, and their production costs money which we can ill afford to lose.

It's an absolutely safe bet that if a few hundred enterprising fireflies were to challenge us to an illumination contest, we would, before entering the competition, have to considerably increase the capacity of our coal bunkers.

## ELECTROLYSIS OF WATER MAINS.

By L. C. Harkness.

As a result of the warnings given out by F. A. Cambridge, city electrician, Winnipeg, that great damage was being done to domestic water pipes and high pressure mains by electrolysis, Winnipeg city council engaged Prof. L. A. Herdt, of McGill University, Montreal, to examine the water mains and report specifically as to the cause and extent of the damage. Prof. Herdt has made an alarming report to the city officials, to the effect that thousands of dollars' damage had been done to iron and lead pipes and the high pressure mains by electricity escaping from the rails of the Winnipeg street railway.

Electrolysis of City Water Mains.

The report bore out in every detail the warnings of Mr. Cambridge, which the city council has heard for the past nine years. The professor made it clear that the board would have to take instant measures to prevent great loss to the city, and he stated that the work of erecting sub-stations on the electric railway, and rebonding of the street car rails should go on night and day until completed. The series of photographs produced by the professor showed clearly the serious manner in which the water mains were being damaged, and several maps which he produced showed that the current was escaping from the rail joints at a rate which if not immediately checked would soon affect the mains in the central portion of the city, if they were not already damaged. The professor stated that the remedy could only be effected by the railway company as the city could do nothing to protect its piping system from stray currents.

Since this report has been submitted the railway company have taken steps to remove the cause of the trouble by rebonding the tracks of their system. They have also began the erection of sub-stations which will decrease the concentrated current in the tracks.

Electrolysis of City Water Mains.

## SOME CURIOUS POWER HOUSE EXPERIENCES.

By J. A. S., Newcastle.

The efficiency of an operating engineer in charge of a power plant is tested not only by the economy which a wise supervision of running operation produces, but also by the facility and resource which are exercised in meeting the abnormal conditions of breakdown experiences. The large variety of accidents which may occur in connection with running electrical machinery, even when limited to the types of plant found in modern central stations, is so great that anything like a complete summary is impossible. It may, however, be interesting to record one or two experiences of generator and motor breakdowns, and the methods by which these were overcome, for the use of other engineers.

### Circulating Pump Motor.

A rather curious incident which occurred in connection with a motor driving a circulating pump may first be mentioned. This motor, which was a new, four-pole direct-current machine, driving the pump direct, was found to spark so severely at the brushes that it was inadvisable, and almost impossible, to run under such conditions. The usual operations of bedding the brushes, measuring their spacing, examining the commutator for flats or raised mica, and altering the position of the brushes, were resorted to without avail, and the trouble then seemed to lie in a fault in con-

struction. The insulation resistance of both armature and fields was taken and found to be satisfactory, and the armature coils were all quite in order.

As a last resort, a copper resistance test was made upon the field coils, and the curious fact was revealed that although the wire on all the windings was of the same gauge, the resistance of one of the coils was ten per cent. less than that of any of the others. Why this was so could not be determined, but the unbalancing of magnetic flux due to this was evidently the cause of the sparking. As the pump was wanted urgently no time was lost in theorizing; a temporary compensating resistance made out of an old field regulating coil was rigged up in series circuit with the faulty field coil and adjusted till the resistances of the four circuits were equal. Under these conditions the motor ran perfectly without sparking until a new coil could be obtained in exchange from the makers of the motor.

Somewhat analogous to this is the case of some trouble occurring on a motor generator converting from a high tension alternating three-phase supply to low tension continuous current. One of the phases of the stator, which was mesh wound, had defective insulation, due to bad workmanship, and it broke down and went to earth. This caused the automatic overload switches on the main switchboard in circuit with the machine to operate, shutting the machine down on both sides. As it was imperative that the overload which was thus thrown onto the other motor generators in the station should be eased, it was decided to try running the machine on two-phases only. The terminals of the faulty phase were disconnected and it was found that when running in this way the machine was able to carry a light load, sufficient to carry the station over the peak.

### The Human Element.

Many of the emergencies in central station plant occur through mistakes on the part of the operators; the human element of engineering is the most difficult to regulate. As a case in point, the accidental pulling out of the field switch of a loaded motor-generator, converting from one continuous current pressure to another, owing to the operator mistaking it for that of a machine which had just been shut down, led to a considerable amount of trouble. The motor generators were at the time running in parallel on the net-work, together with other motor generators in sub-stations, supplying the consumers' mains and charging the batteries. On the deprivation of its field the machine flashed badly on the high tension and low tension commutators and raced away.

The main switches on both the high and low tension sides were immediately pulled out, probably saving the machine from destruction due to centrifugal force, and the other machine was started up. The first machine had suffered slight damage to one of the commutators, and the brushes, which were of gauze, were burnt up. The other motor generators at the sub-stations took up the load to a large extent during the trouble and these were assisted by the batteries. These unfortunately suffered considerably by the heavy overloads thrown on them during the continuance of the trouble, and this incidentally shows the very prompt way in which a battery will rise to a sudden rush of load, as there are no clogging effects either of inertia ior induction to introduce a time element.

In order to bring the disabled motor generator back into operating condition again, the connections on the low tension armature of the machine were reversed, in order that subsequent operations would not reverse the field. A fresh set of brushes was put on the machine, and this was then run at a slow speed from the low tension busbars. It was then possible to bring up both commutators to surface again with emery cloth and burnishing, and the machine was then restored to its normal condition. As a preventative to further troublt of this description, an interlocking device between the field switch and the high tension main switch was arranged on the switchboards for every motor generator throughout the system.

### Arc Lighting Machine.

A rather curious experience occurred in connection with a compound wound continuous current low tension arc lighting machine, which was found to be unable to do its usual work of lighting a fixed number of direct current arc lamps, used for public street lighting in parallel series. Various tests were applied to the machine, but no amount of running up and other attentions wou'd get it to excite. It was finally found that the resistance of the circuit to be supplied had been considerably increased by the disconnection of several lamps, this circuit resistance being then very high in comparison with the internal resistance of the machine. The difficulty was temporarily overcome by keeping all the lamps switched on and running up the machine to full speed. A short length of cable was then flashed across the brushes of the machine, producing a momentary short circuit or very low resistance across the terminals. The temporary reduction of external resistance to this extent was sufficient to start the building up of the field, and there was no further trouble throughout the whole of that evening's run.

The process was repeated successfully for several nights, until it was realized that the number of arcs would be permanently reduced. For this reason, leads were taken from the two poles of the machine to a spare automatic overload switch located on the main switchboard, so that when the switch was closed it would short-circuit the machine. When the machine was started up for its evening's run it was short-circuited by means of this switch. As soon as the machine excited itself the switch automatically opened and diverted the current into the arc lamp circuit.

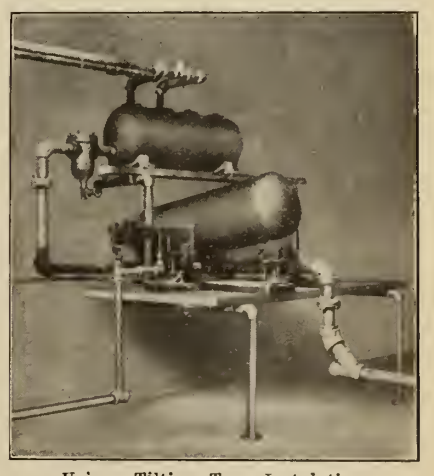
It will be seen that the above four illustrations of station emergencies, although limited to running electrical plants, nevertheless present entirely divergent classes of trouble. There is, therefore, a considerable amount of ground for the assertion that, while an operating engineer should school himself against emergency by thinking out in advance all the weaknesses that threaten the life of the plant, and also the best way of combating them, his chief value will oftentimes lie in his resourcefulness and quick initiative in order to save, perhaps, a heavy value of plant.

---

## UNIQUE TILTING TRAP INSTALATION.

By Frank C. Perkins.

A considerable saving can often be made in steam instalation where condensation at high temperature is found by instaling tilting traps of approved design. These unique devices can often be utilized to advantage, saving the cost of steam necessary to operate a pump for handling the water.



Unique Tilting Trap Instalation.

The accompanying illustration shows a tilting trap instalation used in connection with a large brewing kettle which requires live steam in its operation, with condensation of over 3,000 lbs. of water per hour to be handled. Before using the tilting trap this condensation was pumped into the boiler at

about 130 degrees from an open tank into which it was discharged from the kettle.

The tilting direct return trap was placed on top of the boiler and above the trap was placed a receiver, as shown in the illustration, connected to the return line of the kettle.

From the receiver the condensation water passes to the trap and is automatically discharged by gravity from the latter into the boiler through a pipe connected to both blow-offs. It is stated that a test showed the condensation was being discharged by this equipment into the boiler at a temperature of 250 degrees at the rate of 3,028 lbs. per hour, resulting in a saving of several hundred dollars per year with but slight expense for equipment.

## SMOKE PREVENTION IN STEAM BOILERS.

By Peter Bain, M.E.

It is not the purpose of this article to discriminate between types or makes of boilers, hand or mechanical firing, types or makes of mechanical appliances, composition of fuels, forced, induced or natural draft, etc.; but rather to point out that smoke prevention is a reality and a possibility if you will.

The conditions enumerated above may and do affect the degree of success attainable, and what is perhaps always to be desired, minimise the labor of the fireman, although unfortunately oftentimes accompanied by sacrifice of the latter's skill.

### Smoke Burning — Smoke Consuming — Smoke Production.

It may be as well to state at once, that smoke prevention is what is wanted, not smoke burning or smoke consuming. The highest scientific authorities are agreed that smoke production means loss, that there is no real method of burning or consumiug it, and that absolute immunity is only to be found in prevention or nonmanufacture of it. It does appear, however, as if smoke production was remunerative, judging by its persistent and voluminous daily output.

It is not sufficiently recoguized that with perfect combustion, there is greater efficiency, greater economy, and an entire absence of smoke. Owners of steam plants in factories large and small, are generally unaware of the fact that many, it may be of their competitors, are burning bituminous or soft coal practically without smoke, and with a correspondingly increased efficiency and economy. If this consnmmation can be realized in some plants, it is only reasonable to expect it in all. Gas, gasoline, kerosene oil, etc., may be burned smokelessly under favorable conditions, and bituminous coal can be equally treated, in a properly designed, arranged and operated steam boiler furnace.

### Losses Due to Smoke.

Much is made of the dollars that go up the stack as smoke judging by the representation of terrific volumes of black smoke shown on illustrated advertisements. The actual loss of carbon in the form of soot or heavy black smoke does not exceed 3 per cent. of the total carbon in the fuel, even with forced combustion, and were it not for other and more vital considerations, would be treated as of small import. Other losses equally real, though perhaps more indirect and less capable of being fully estimated, are incurred, and to a much greater extent, by the hindrance to heat transmission of the hot gases to the boiler plates and the water. The boiler surfaces, flues and tubes become coated with a fine layer of carbon dust, almost impalpable, but nevertheless a most effective non-conductor and economy destroyer.

Again from the hygienic, the scenic, and picturesque landscape point of view, the importance of smoke prevention is so palpably apparent to even the most uninitiated, that comment is needless, the evil being a crying one and the only apparent remedy, legislation and its enforcement.

### Professional Versus Legislative and Enforcement Remedy.

That these latter should be necessary to advance this particular pbase of steam engineering to its proper place in the profession, seems in view of the spontaneous and almost perfect attainments in other directions, indeed ludicrous. Blame for, and in the writer's opinion cause for this state of affairs, has been the disposition of most authors of magazine articles, to fix the responsibility over too wide a field.

In order of default the responsibility has been usually apportioned as follows: 1. Manufactnrers of furnace apparatus. 2. Consulting engineers (and architects?) 3. Purchasers who operate the apparatus. That each and all contribute either directly or indirectly to smoke production or smoke prevention, or that one or other counteracts the effort for prevention by the remainder of the combination, must be accepted, yet conclnsions so based are generally worthless from the remedial viewpoint. Admittedly all with the exception of architects are part of the combine, bnt all are not equally responsible.

In the first place a purchaser does not need to take nor should not take any furnace apparatus that an expert salesman may talk him into. An important consideration like the purchase of furnace apparatus should bar the deal in this respect, because neither understand the technical position sufficiently, and both they and the firms they represent are liable to suffer disappointment afterwards.

In the second place, although a consulting engineer should always be retained, as well as wholly blamed, (we are now locating the responsibility), discrimination should be used in his selection, because the expression consulting engineer covers an enormous field of operation, wide as the poles and distinct as day and night. A bridge expert is not expected to know the minutiae of turbine pump design, neither is a mill expert expected to know all the refinements of marine propulsion. Each is a specialist in his own line, and each is in demand by his own line; likewise in the selection of an advisor for a steam boiler and its equipment, a specialist should be engaged, one who will shoulder the responsibility, because he knows how to bring satisfactory results. Purchasers, however, experience goes to prove, are averse for the most part to the retention of an expert, hence instead of occupying third place as previously noted, theirs is in the writer's opinion, first easily, sharing the doubtful honor with manufacturers of apparatus, while consulting experts are not in sight.

It must be admitted however, that there are exceptions, and these have proved the advantage of the system recommended. From an engineering standpoint legislation and enforcement are unnecessary as well as undesirable. More general recognition by purchasers that expert advice means plant economy and efficiency for single and double or multiple battery boilers, and will in the very nature of things be always most potent, as altogether most satisfactory to the varied interests concerned, is what is wanted.

### Smokeless Furnace Requirements.

New plants or projected extensions should be equipped and operated, with and by the most perfect and up-to-date methods available. Existing plants which are doing moderately well, should have steps taken toward improvement of apparatus and manipulation, while badly designed equipment should be cleared out or rearranged, as no perfection of their operation alone in many cases would result in betterment.

The coal should be supplied to the furnace in small quantities at frequent intervals, and the more uniform and continuous the supply, the more satisfactory the results.

The air supply should be slightly in excess of the theoretical amount required, say from 30 to 50 per cent., and be admitted principally through the fuel bed, with an auxilliary supply at the front over the fire and at the firebridge.

Its temperature and that of the furnace should be sufficiently high, to ignite the gases given off from the fuel bed, and if properly regulated as to quantity, time and place, according to the fuel used, the stack will be practically smokeless. There should preferably be a firebrick combustion chamber of sufficient size, and so designed, as to cause thorough mixture of the gases with the air; permitting complete combustion before contact with the boiler surfaces. Care should be taken to keep these surfaces clean.

The efficiency of the furnace, and the degree of success attained, by any smoke prevention equipment, depend on the skill of the fireman, proper design of the furnace, boiler setting, character of coal, capacity of boiler and furnace, and load carried.

**Hand Firing Conditions.**

Few firemen can be induced to fire regularly and frequently, because it is easier to put in enough coal at one time to last twenty or thirty minutes, than one third the quantity every ten minutes.

The hand firing of boiler furnaces sometimes violates all the principles of perfect combustion. Fuel is supplied in large quantities at long intervals, resulting each time in the temperature of the furnace being lowered; in increased resistance to the flow of the air through the fuel bed, and in great quantities of combustible gas being released unconsumed, through lack of air and the necessary amount of heat. Hand fired furnaces with ample combustion chambers and regulated air admission are suitable for most kinds of coal, if tended by careful and experienced firemen, and give highly satisfactory smoke prevention results. With widely varying steam loads, they are also satisfactory.

**Mechanical Firing Conditions.**

As with hand firing, difficulties are also met with in mechanical stokers. The greatest of these is perhaps the tendency of the fireman to poke the fires unnecessarily, instead of using or adjusting the coal handling and feeding attachments provided. Where it is possibl., they will shovel green coal into the furnace instead of feeding through the hopper, and then take a bar and stir up the fresh coal with the coke and ashes, causing smoke and waste.

Mechanical stokers generally are conducive to improved combustion by their elimination in large measure of the fireman's skill, their regulation of the air supply, and more continuous fuel feed. Their adoption is confined, however, to large and moderate sized plants, which afford more opportunity for economical efficiency, in addition to smoke prevention, than do single boiler plants and such like.

**General.**

It is generally conceded, that intelligent men trained in boiler room practice could save 10 per cent. of the fuel used, in 50 per cent. of the plants in operation, and that in another 25 per cent., such men could save 5 per cent. of the fuel. It is to the advantage of the owners of all large power plants, to employ a boiler room expert, who will make frequent tests and investigations, to determine and maintain the conditions favorable to the highest economy. The saving of only a small percentage of the coal consumed, will make a handsome return, for the cost of this work.

There are now in a few of our large cities, competent engineers who are making a specialty of supervising boiler plants, which serves to show that the management of the boiler room is a problem for properly qualified men. As the coal burned is a considerable item of expense averaging about 50 per cent. of the cost of power production, there is more opportunity to save in the boiler room than in the engine room, with any given equipment.

Boiler rooms are generally speaking hot, dirty, and places to be shunned, for which reasons little attention is paid to them by superintendents, and operating engineers, particularly in moderate sized plants. Their operation and management is often entirely left to men engaged not for their skill and knowledge, but for their ability to do hard work, at apparently low cost.

The increasing use of gas for domestic, manufacturing, and power purposes, and the centralization of power and heating plants, tends to relieve cities of a large percentage of smoke, yet nevertheless, it will be necessary to burn coal in large and small boiler plants for some considerable time to come, a contingency which will help to keep the problem of smoke abatement prominent.

---

## BOILER EFFICIENCY.

By A. J. D.

I would like to direct the attention of the readers of The Power House to the possibilities of improvements in operation and efficiency of boiler plants.

Most engineers will agree with me that a large percentage of the boilers in use to-day are overloaded, and that it is difficult to hold required pressure. Very many of them could be made to operate much more efficiently by a careful consideration of the local conditions and boiler settings and fittings.

Naturally the draft is first to be considered, as it is of great importance, and few engineers realize how much depends on the seemingly small details, or that the draft can be greatly reduced by leaks in setting and flue connections, short, abrupt turns, or restricted passages in path of gases from furnace to chimney.

I have seen a boiler fitted with an 80-foot stack connected to boiler through flue with two right-angle turns that failed to give a natural draft as good as that of another boiler with stack only 50 feet high, but placed directly over top of front smoke-box. I also had charge of a boiler plant at one time fitted with short stacks and forced draft, supplied by fan, driven by small steam engine and air being delivered under grates from ducts under floor.

As originally installed, the boilers were fitted with bridge walls that were only 6 in. from bottom of boiler, at centre of wall, and the ends of bridge-wall were raised to form a curved top of slightly greater radius than the diameter of boiler. (See Fig. 1). These boilers had to carry a very heavy overload at times and were fired with heavy

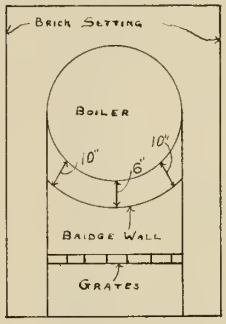



Fig. 1.

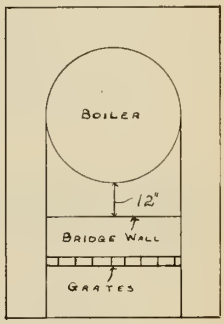



Fig. 2.

fires and forced draft, it being necessary to run fan so fast that ashes and dust were blown out of cracks around ash pit doors and fire out of furnace doors when opened, until firemen were almost driven out of the boiler-room. Boilers also began to leak at girth seam just back of bridge-wall, and fronts could not be kept clean, and although this was a new plant it began to look very bad.

As an experiment, one of the bridge-walls was rebuilt, making it 12 in. from boiler at nearest point, and straight across the top, as shown in Fig. 2. The result was that the heaviest load could be carried with ease with one boiler less than before; a light, thin fire was carried and fan run just fast enough to keep a nice white fire all the time. Boilers have not needed any repairs since then (two years ago) and much less coal is used and the work of firing is not nearly so unpleasant and difficult.

The trouble in this case was lack of room for free passage of products of combustion and cooling of gases by contact with boiler before they had time to thoroughly mix with enough air for complete combustion.

## PUMP REPAIRS.

By D. F. Crowther.

How often we see pumps placed where it is impossible to make repairs without going to more expense than necessary, by the lack of a little forethought. The way of getting round a case of this kind may be of use to others.

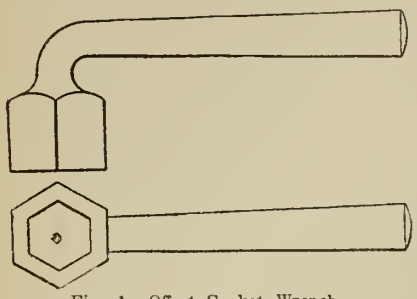


Fig. 1.—Offset Socket Wrench.

A tank-pump, 5ft. long, was placed in a pit, and held down with concrete, with a space of 9 in. between the water-cylinder head and the wall, and 26 in. on the steam end. The rod in the pump was to be renewed, and a new one was got before the question of getting the old one out came up, so that when the

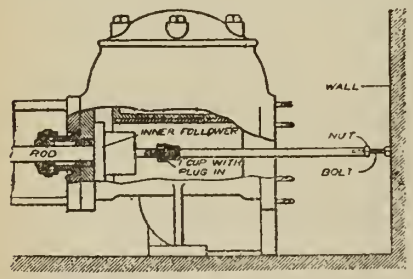



Fig. 2.—Removing the Follower Plate.

time came, there was some thinking, as the pump could not be stopped more than half a day. After looking matters over, it was found that if the stuffing-box gland on the water end could be taken out, the rod would swing by the steam cylinder; so two socket-wrenches,

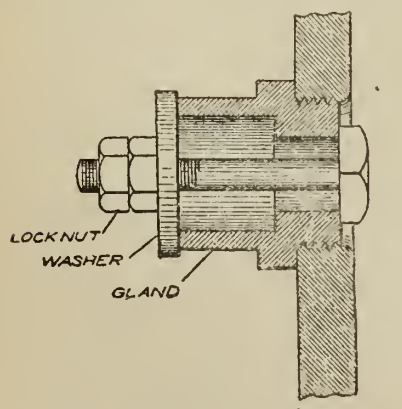



Fig. 3.—Pulling Out the Gland.

as shown in Fig. 1 were made, one for the cylinder-head bolts and the other for the rod-nuts. The inner follower being hard on the rod, a jack was made by taking a piece of pipe and putting a reducing coupling on, then putting a pipe plug in the coupling upside down to rest against the rod. A bolt with nut was put in the other end and rested against the wall, and by turning the nut off the bolt, the follower came off easily. Fig. 3 shows now the gland was taken out after the rod was pushed through, and the steam-piston head taken off without trouble, as that could be got at when out of the cylinder.

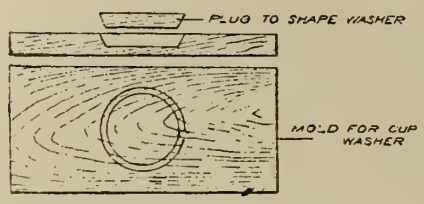



Fig. 4.—Disc and Plug for Cup Washer.

In this pump, the gland screwed in so that a bolt with a large square head was put through the gland from the inside of the cylinder, and a thick washer with two nuts to hold it was drawn tight against the gland. By turning the inside nut, which is locked by the other, and tapping the gland, it soon came out.

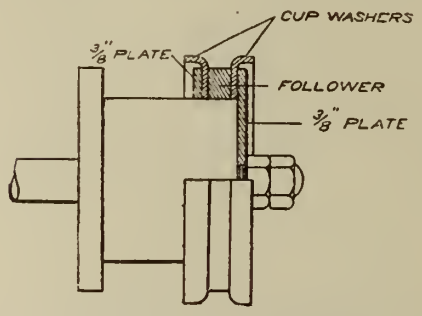



Fig. 5.—Arrangement of Cup Washers and Follower in Place of Packing.

I have found this one of the best ways of getting glands out and followers off; only, where the gland is forced in, use a yoke.

When the gland came out it was found that the hole was not tapped square with the cylinder, which was the cause of the leaking rod and the pump not working right. As squaring the hole was harder than crossing the gland thread, the latter was done in a lathe,

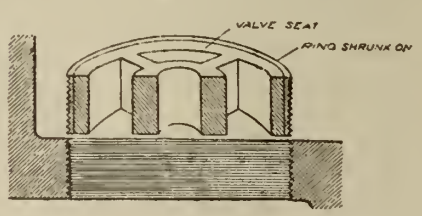



Fig. 6.—Ring Shrunk on Valve-Seat.

after the amount was found by using a pine plug when centring the piston.

When the follower came off it was found that the retaining pieces that held the packing were worn out, so it was decided to use cup washers, and a mould was made of plank as in Fig. 4. Some pieces of belting furnished leather, and two ⅜ in. washers were made from plate to hold them to the cylinder wall, and a nipple did for a clearance-piece, being put in as in Fig. 5. A nipple, ⅜ in. washer, a cup washer, then the outer follower for the cups to rest against,

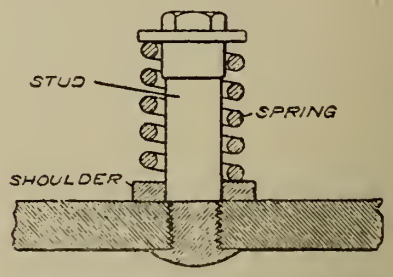



Fig. 7.—Shoulder Stud and Method of Holding It.

then cup, ⅜ in. washer, nipple, and nuts. After getting the gland in as it was taken out, and the head fixed, a look at the valves found some of the threads on the studs worn so that they were loose. They were heated and expanded by driving a centre-punch in the ends. The whole for one of the seats was worn so much out of square that it had to be filed and a ring shrunk on the valve-seat, as shown in Fig. 6. Fig. 7 is shown where the thread in the valve-seat is gone; in this case a shoulder-stud was made and riveted into the seat while a nut on the top adjusted the spring, and for our four hours' trouble we got a good working pump.—Practical Engineer.

---

## INJECTOR INFORMATION.

By K. Campbell.

The injector—The greater the lift, the smaller the quantity of water which can be handled by the injector. A long pull through horizontal pipe tends also to reduce the amount handled by the injector. An allowance equal to about one foot of lift for each fifty feet horizontal pull will be found about correct.

The elevation of water supply above injector level slightly increases the minimum capacity of injector, that is, it is not possible to cut down the capacity to quite so small an amount when water supply is so situated. The same rule applies to a supply from waterworks pressure. But a hotter water supply can be handled from an elevated tank than from a lift.

Hot water supply decreases capacity. Capacity (or water delivered at different pressures) is not materially affected by the temperature of the water below summer heat, yet a greater amount of water can be handled below 74 degrees than above.

# Correspondence and Discussion on Previous Articles

Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### REPLIES TO QUESTIONS.

Almost every issue questions are asked under the heading of correspondence. In reply to these we wish to get the opinion of engineers generally. In the July issue was a question on back pressure and in this issue (August), are a number of other questions. We pay for all letters containing useful information, either discussion on previous articles or replies to questions asked in these columns.

Address all letters to The Power House, 10 Front St. East, and they will reach the editor.

### CARE OF BOILERS.

Seeing under the heading of Correspondence, page 48, "Care of Boilers," June, 1909, in your valuable paper, The Power House, where brother Mac has used coal oil in his boilers, could it be pumped in while the boiler is under pressure and engine running, without causing priming or other danger? As I have never tried it, I would like some further advice before buying it. I have only one boiler.

EDWARD THOMAS.

In the June number "Mac" gave some advice in his letter which might get some of the younger generation of engineers into trouble (especially if they had no experience with coal oil purge), by using coal oil in a badly scaled boiler and firing up before removing the scale. A bag is almost sure to result, as it removes the scale but does not soften it.

Although one of the boilers under my charge is equipped with the cast iron pan arrangement over tubes, I do not altogether favor it. There may be engineers who favor top feed, others like the blow off feed, etc. I believe the top feed is ahead, by a long way, over the blow off one, but still it is not the best method of feeding a boiler. The only correct and rational method of boiler feeding is that proposed some years ago by the Hartford Boiler Inspection and Insurance Co., and described as follows:

The feed pipe enters the front head just above the upper row of tubes and close to the shell, and after entering the boiler it passes down nearly to the back head. It then crosses over to the other side of the shell and turning downward, discharges between the shell and the tubes. By this method the feed water becomes well heated before discharging into the boiler and fireman can regulate the water supply without leaving his post. Brass pipe is preferable to iron for feed pipes since it is a better heat conductor and will not scale as readily as iron. Personally I do not favor coal oil as a scale or boiler purger. It will in many cases remove the scale, but there is much danger to the boiler, if the attendant is in any way careless in using it. In view of the fact that there are a number of effective and harmless boiler compounds at reasonable prices on the market, it would appear to be folly to use as uncertain and hazardous an agent as coal oil for this purpose.

An experienced engineer who has had considerable experience in the use of coal oil in boilers recommends its use as follows:

When you put coal oil in a boiler it will rise to the surface. It never does the boiler any good to feed coal oil to a boiler when it is in use, as it will be evaporated and pass off with the steam. Let the fire out and when steam is down put one gallon of coal oil into the boiler and let it stand half an hour, then partly open the blow-off cock and allow the water to pass out slowly. The oil will work all around the tubes and boiler surface. Let the boiler remain empty about an hour, then thoroughly wash out the boiler with the hose and cold water and remove all loose scale. The boiler can then be filled and fired up.

The idea is this. The oil will loosen the scale to a certain extent and in washing with cold water the shell is contracted which causes the scale to fall off, and it can then be removed before filling up. Otherwise the scale would fall off and lay on bottom sheet, and migh tcause a burned or bagged sheet.

I am not claiming to be right and Mac wrong in this letter. It is only an exchange of personal opinion, which I believe is what is wanted in this section.

JAMES E. NOBLE.

I noticed in the last issue of The Power House references made by Mac to the use of oil in boilers. William P. Bruce, in a recent issue of Power, discusses the question and what he says will no doubt be of interest to the readers of The Power House.

"Where sulphur water and oil from open feed-water heaters are to be contended with, the proper use of kerosene is all that can be desired. I have used it for years under these conditions, and find it to be safe and not injurious to the boilers. In water-tube boilers place about 5 pints in the mud drum before filling with water, so it will be deposited on the tubes and drum shell.

"When filling a boiler, the kerosene oil is deposited upon the scale or cylinder oil and penetrates to the metal. Then heat is applied to the boiler and it is transmitted to the water. The temperature will gradually rise from the point before the application of heat to the point of vaporization. Just at this point the vibrations of the molecules of the oil, which have become more and more rapid as the temperature has risen, have become rapid enough to overcome the force of cohesion which tends to keep them together. The oil begins to change to a gaseous form, or vapor.

"The expanding of the molecules at such rapidity tends to loosen the scale. My theory why this condition does not continue until the flash point of the oil is reached is because there is insufficient oxygen present."

K. CAMPBELL.

### HOW SHOULD THE VALVES BE SET?

In reply to the enquiry of E. B. P., in the July issue, re valve setting and horse power, I offer the following solution, which covers the information he wants. The cards show a good valve setting, but could be improved by making both exhaust valves open a little earlier, giving the head end the most, (as it is a little later than the crank end), s as to give the toe of the cards a rounded effect, as in Fig. 1. The effect will be to carry the compression a little higher, which, in my opinion would be an improvement. The M.E.P. by planimeter is, 53.5 lbs. for the crank end, and 53 lbs for the head end; the average will be

$$\frac{53.5+53}{2}=53.25 \text{ lbs.}$$

for No. 1 cards.

The M.E.P. for No. 2 cards is 71 lbs. and 73 lbs. for head and crank ends respectively, the average being 72 lbs.

The indicated horse power can now be found. The cylinder dia.=24" and area =452.39 square inches. The stroke=42"=3.5 ft. The I.H.P.$=\frac{\text{PLAN}}{33{,}000}$, substituting the figures we have,

$$\text{I. H. P.} = \frac{53.25 \times 3.5 \times 452.39 \times 148}{33000}.$$

$$\text{for No. 1 cards} = \frac{12478768}{33{,}000}$$

=378.14 I. H. P.

For No. 2 pair substitute the M.E.P. 72 lbs for 53.25, which becomes

$$\frac{72 \times 3.5 \times 452.39 \times 148}{33{,}000} =$$

$$\frac{16872337.44}{33000} = 511.28 \text{ I.H.P.}$$

Overload on No. 2 card shows

$$\frac{511 - 378}{378} = 34\%$$ more work, if it occurs regularly is not economical. Where there is sufficient compression, the clearance can be neglected and the following fomula will give the steam consumption per I.H.P. per hour, as accounted for by the indicator:

$$Q = \frac{13{,}750 \times l \times W}{MEP \times L}$$, where Q=steam consumption per I. H. P. per hour.

13,750=a constant.

l= length of line l (Fig. 2) in inches, and is drawn on the card parallel to the atmospheric line, so that it touches the expansion line before releasing, and the compression line before steam admission.

L=total length of card in inches.

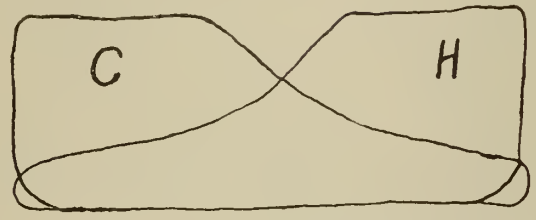
W=weight of 1 cubic foot of steam at pressure am+14.7 lbs. The pressure am is obtained by measuring with a scale corresponding to the spring of indicator.

l= 3.25.'' L=3.625,'' MEP=53.25, am =29+14.7=43.7 lbs. From the steam tables the weight of 1 cubic foot of steam at 43.7 lbs. absolute =.105572 lbs. Substituting these figures, we have $\frac{13{,}750 \times 3.25 \times .105572}{53.25 \times 3.625}$

$$= \frac{4{,}717.75}{193} = 24.45$$ lbs. per I.H.P. per hour.

The steam consumption from No. 2 cards is 34.2 lbs. per I.H.P. which shows an increase of 9.75 lbs. per I.H.P. due to the overload. The method of finding the steam consumption from No. 2 cards is different from No. 1, on account of the expansion line being so high. I will endeavor to show how I obtained it on another occasion.

JOHN C. TWEEDALE.



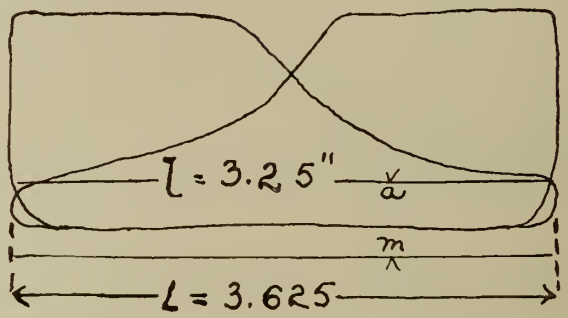




Fig. 1.—How Should the Valves be Set ?—Fig. 2.

## ENGINE CARDS.

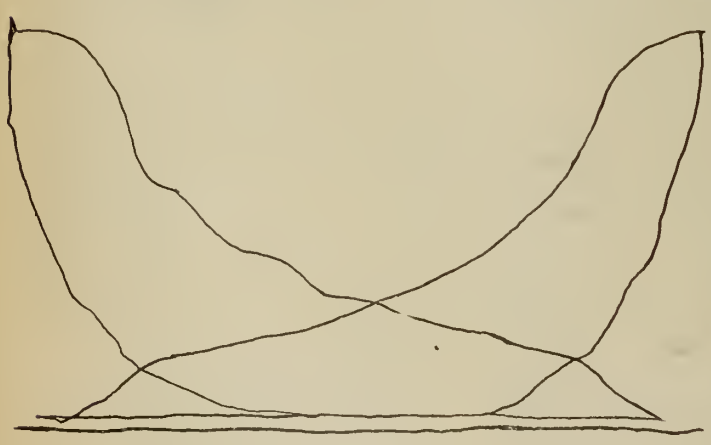
You will find enclosed a set of three cards taken from my engine, which I would like to have inserted in The Power House for criticism and suggestions for the betterment of same. My engine is a Robb-Armstrong, centre crank, Robb-Armstrong-Sweet balance and wheel governor.

Card 1—Diam. of cyl., 12'' ; length of stroke, 14'' ; r.p.m., 220 ; boiler pressure, 90 lbs.; scale, 40.

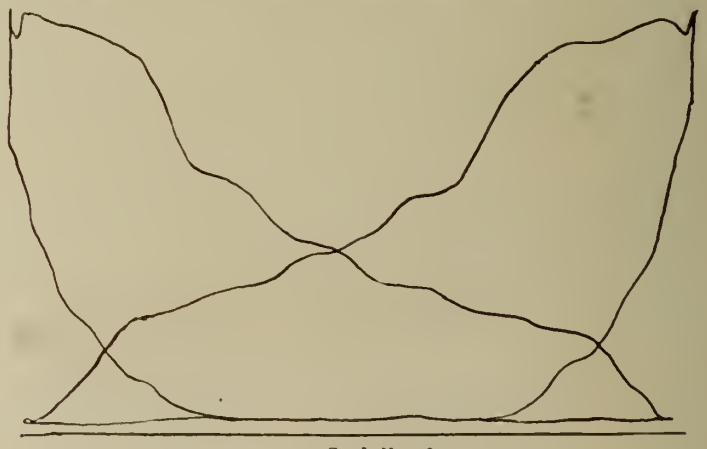
Card 2—Diam. of cyl., 12'' ; length of stroke 14'' ; r.p.m., 220 ; boiler pressure, 90 lbs.; scale, 60.

Card 3—Diam. of cyl., 12'' ; length of stroke, 14'' ; r.p.m., 220 ; boiler pressure, 90 lbs.; scale, 40.

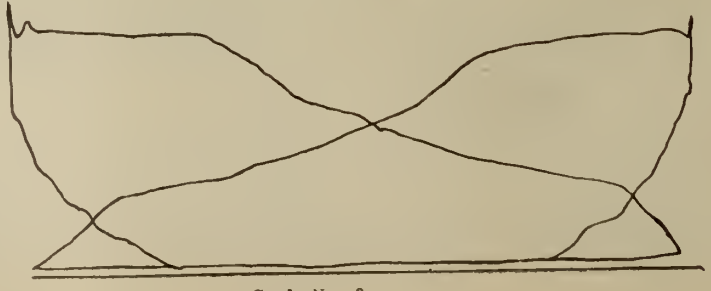
F. A. MAC'L



Card No. 1.



Card No. 3.



Card No. 2.

Where no facilities are provided to prevent the feed pipe inside of the boiler becoming lined with hard scale, it should be put together with unions instead of couplings, to save a hard, hot job when the pipe must eventually be taken out.

To make an oil chain in a hanger-box run, put a centre-punch mark on the shaft where the chain tracks. The chain channel should also be freed from sharp corners and the small ends of the links should point in the direction of rotation.

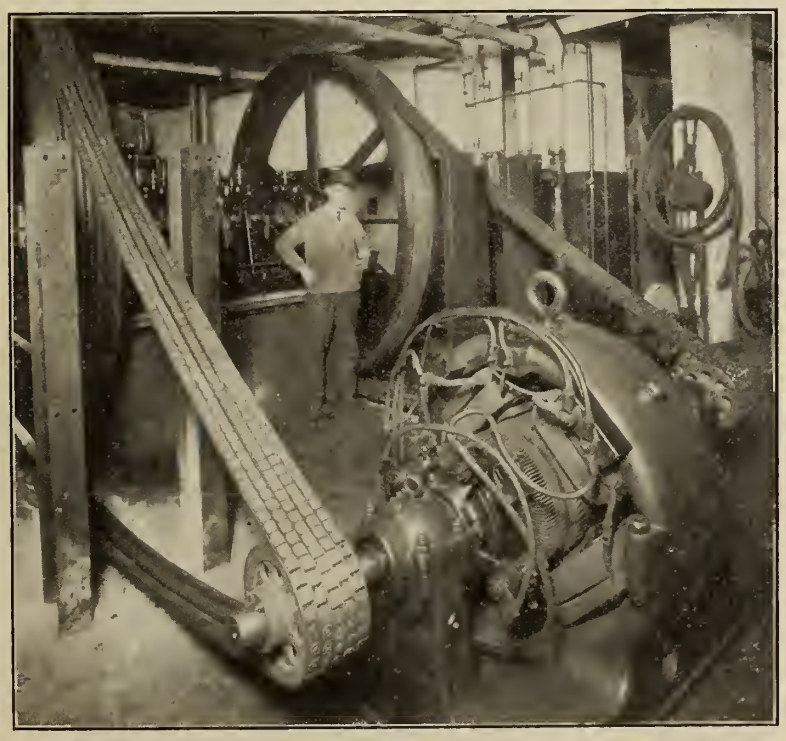
# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### PEERLESS V-BELT.

The constructive parts of this belt are two: The core and the casing. The core is a V-shaped bevel-link chain. Every part of this chain is made of pack-hardened machine steel, on which a file cannot make an indentation.

The casing is again composed of two parts; an upper and a lower. The lower part is a continuous strip of rawhide covering the bottom and the two sides of the chain. This special prepared rawhide, covering the side faces of the chain, gives it a friction surface unsurpassed for efficiency. The upper part of the casing is a sectional strip of friction material, one section to each link of the chain, and cut at an angle so as to continue the friction surface of the sides. Each section is fastened to the link by a rivet passing through it.



The Peerless V-Belt in Use.

The illustration shows an hydraulic pump running the elevator cars in a sky-scraper, under 900 pounds pressure. It is driven by a 50 h. p. el. motor placed at 11 ft. centres. Ratio of diameters is about 1 to 10. Formerly this was equipped with two 12 in. flat belts each pressed down by an idler equivalent to 230 pounds weight. Under these conditions the intermittent work of a second pump was needed to keep up the pressure. With the V-belts, there being no idlers and no slippage, one pump does the work, this gives a saving of 820 Watts or 1 1-10 h.p. per mile's run, or about 6 per cent. on all the power used.

The small size belt $\frac{7}{8}$ inch across the top is calculated to transmit 1 h.p. per minute for every 200 ft. of lineal contact. The large size belt, $1\frac{1}{4}$ inch across the top, needs about 130 ft. of lineal contact per minute per h.p. This estimate holds true as long as the central distance indicated on enclosed data sheet is allowed to be given. It should be noticed that these centres are already very short, hardly any longer than those used for chains.

This belt has a wide application for direct motor connection, for air compressor drive, ventilators, flour mill rollers, tanner drums, refrigerating machines, electric motor from $\frac{1}{2}$ up to 100 h.p. gas and gasoline engines, ash conveyors, etc.

The Peerless V-Belt is manufactured by the Peerless V-Belt Co., 215-219 So. Clinton St., Toronto.

---

### STARTING PANELS FOR D. C. SERVICE.

The use of starting panels for direct-current motors instead of a starting rheostat with separate switch and fuses, is becoming quite universal in a large number of industries, largely because the panel insures a more satisfactory location for rheostat, fuses, switch or circuit-breaker, than is often accorded to some of these parts when mounted separately.

A line of starting panels has recently been placed on the market by the Westinghouse Electric & Mfg. Co., ranging in capacity from a starter for a $\frac{1}{4}$ h.p. motor at 110 volts to one for a 130 h.p. motor at 220 volts, including panels for 500 volt circuits. These panels are made up in several different styles and can be mounted with wall brackets or on tubular supports resting on the floor.

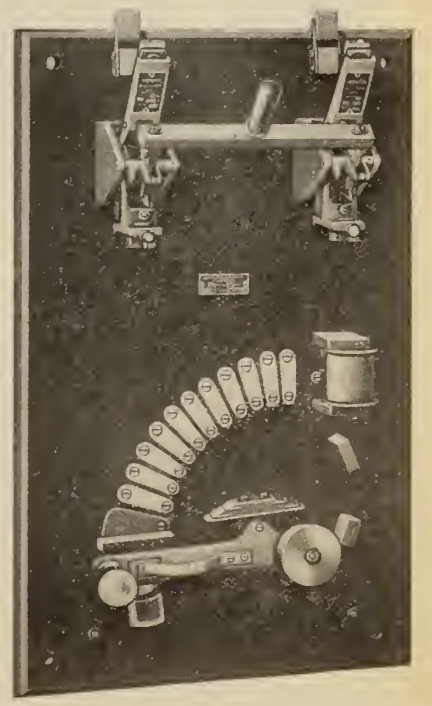


Fig. 1.—Starting Panels

Each panel consists of a slate slab on which are mounted the rheostat contacts and contact arm, the main switch and fuses or the circuit-breaker. In the smaller sizes the resistance is mounted on the back of the panel, but in the larger sizes it is mounted separately. Five terminals are provided for connection to the line wires and the motor leads, and are plainly marked so that it is difficult for a man, even if unfamiliar with starting apparatus, to make a mistake in connecting, especially as a diagram is sent with the starting panels.

Fig. 1 shows what is known as a type "ZB" starting panel, with a carbon break circuit-breaker, and Fig. 2 shows

a type "ZA" panel, which has the same arrangement of face plate contacts, etc., but has a main switch and fuses, instead of a circuit-breaker. All sizes are provided with low voltage release devices which automatically return the contact arms to the starting position on inter-

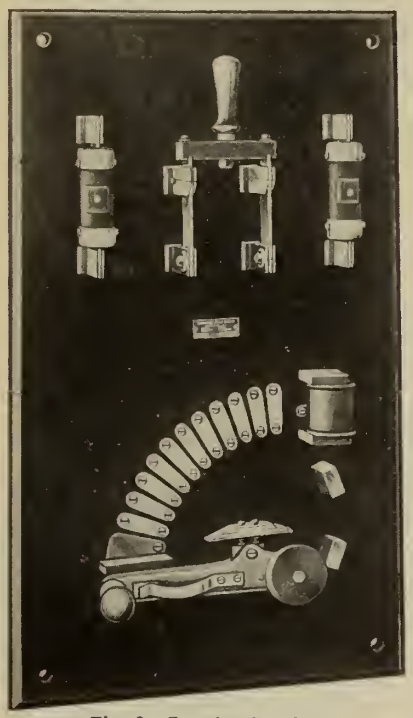


Fig. 2.—Starting Panels.

ruption of the power. Fig. 3 shows the diagram of connections for a "ZA" panel for a 1¼ h.p. motor. It will be noted that the low voltage release coil is independent of the field circuit, so that the starting panels are suitable for shunt, series or compound motors.

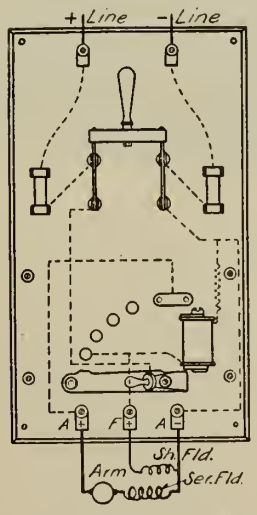



Fig. 3.—Starting Panels.

All contacts on sizes over 1¼ h.p., either 110 or 220 volts, are renewable from the front without disturbing any connection. In all sizes the initial contacts are protected from burning by a quick break arcing tip on the front of the panel or by a blowout coil on the rear, which prevents burning the contact on opening the circuit.

The question of whether a panel with cuit-breakers do not have, that is, if preferable cannot be answered definitely to apply to all instalations, each has its advantages and hence its own particular field.

Fuses have a time element that circuit-breakers do not have that is, if fuses and circuit-breakers are rated to open the circuit at a certain current, the breaker will positively open the circuit as soon as the current reaches that valve, even though the current remains at this high point only a very short time, while the fuse will carry currents in excess of its capacity for brief intervals. For this reason fuses may be preferable for motors that are liable to very brief overloads, especially where expert supervision of the electrical apparatus is maintained, such as in large mills and factories. A supply of extra fuses must be kept available. As circuit-breakers can be reset in less time and with less trouble than is required to replace blown fuses, it is often preferable to use circuit-breakers where time-saving is an important consideration.

## HIGH SPEED PUMP.

Excelsior high speed pumps are fitted with Gutermuth valves. These valves consist of a strip of phosphor bronze or nickel steel sheet, one end of which is coiled upon a spindle to form a spiral, leaving a part of the sheet flat, to form the valve flap proper.

As seen from Fig. 2 and 3 the centre coil of the spiral is bent at a sharp an-

Fig. 2.—Guttermuth Valve—Closed.

gle, which fits into a slot of a spindle, securing the two parts firmly together. The projecting ends of the spindle are

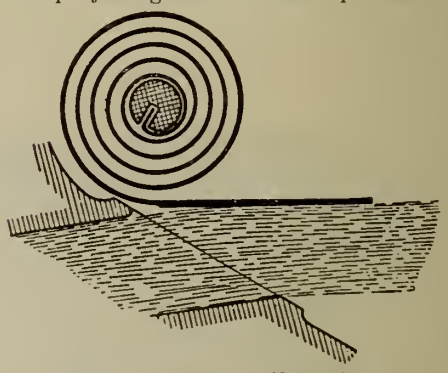


Fig. 3.—Guttermuth Valve—Open.

rigidly held in bearings, so that the flap is in its correct position over the port.

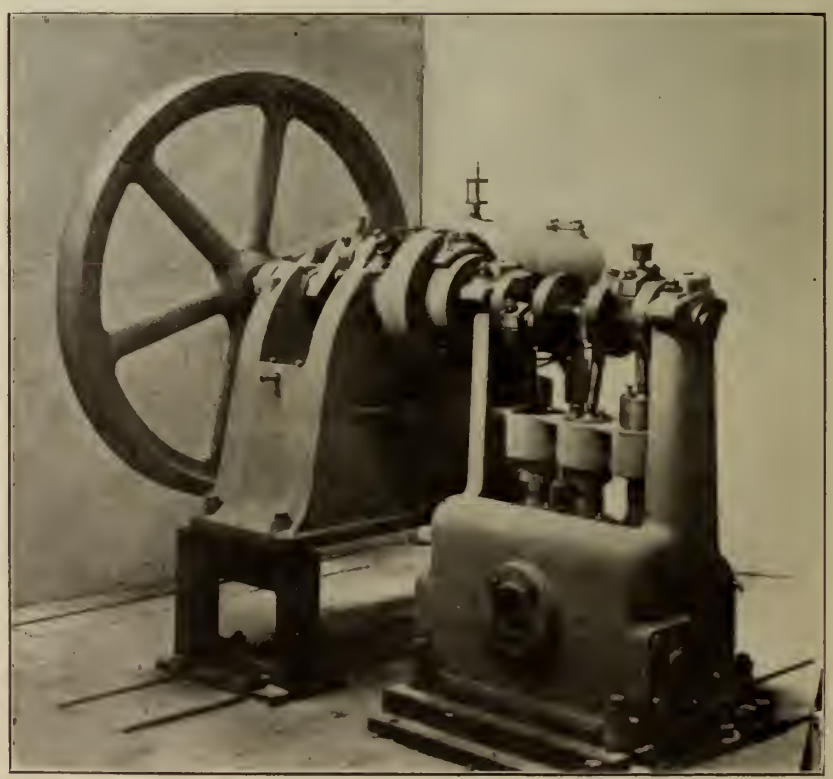


Fig. 1.—Excelsior High Speed Pump Run by Petrol Engine.

It will be seen from Fig. 2 and 3 that the entire opening of the port entails a

minimum coiling strain on the spiral. Nevertheless the spiral exerts sufficient spring power to gently close the flap immediately the current of the water ceases.

Fig. 1 shows a petral engine 6¼ max. h.p. direct coupled by friction clutch coupling to treble barrel vertical 3½" x 4½ high speed pump. The capacity is 6,000 per hr.

As will be seen from Fig. 4 amd 5 the suction and delivery valves for all three pumps are arranged in one conical valve

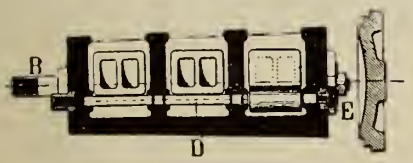



Fig. 4.—Arrangement of Valves.

cage, which, by the breaking of only one small cover joint can be bodily withdrawn from the pump, leaving all pipes and other connections undisturbed. The various parts of the valve arrangement will he clearly seen in the illustration. The valves and valve cage can be removed for inspection or adjustment.

Owing to the possibility of placing these valves in any position, horizontal, vertical or upside down, they are espe-

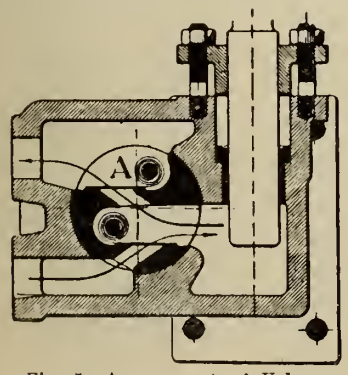



Fig. 5.—Arrangement of Valves.

cially adaptable for sewage pumping, as for this purpose the valves are arranged for the suction to be at the top, and the delivery at the bottom, thereby allowing the valves to be washed clean at every stroke, and all causes of sticking removed, the valves being so arranged in a vertical position that no foreign matter can adhere to the surfaces.

The pump shown in the illustration is being installed in Winnipeg. It was built by T. H. & J. Daniels, for whom Vandeleur & Nichols, Dineen Bldg., Toronto are agents.

## UNIFORM BOILER LAW.

The London Board of Trade at a recent meeting passed the following resolution in reference to uniform construction and inspection of boilers:—

Whereas—The power to pass legislation governing the construction and inspection of steam boilers is vested in the Provincial Legislatures:

Whereas—Some of the provinces have passed Acts that are not uniform, and consequently a hardship on both users and manufacturers of steam boilers;

Whereas—Some of the provinces have no Boiler Inspection Act;

Be it resolved—

1. That this Board petition the Ontario Government to join with other provinces and formulate a Boiler Inspection Act that would protect both user and manufacturer, and that would be uniform throughout the Dominion.

2. That a copy of this resolution be sent to the Premier of Ontario, and to the local representative; also to the Boards of Trade throughout the Dominion, with a request for their co-operation.

In keeping with the resolution the following letter was addressed to the secretaries of the various Boards of Trades in Canada:—

Dear Sir,—

I herewith enclose you copy of a resolution passed at our last regular meeting, with a request that your Board will act in conjunction with the London Board of Trade in petitioning the Premier of your province that steps be taken to formulate a Boiler Inspection Act that will be uniform throughout the Dominion.

Acts in force in some of the provinces at the present time are ambiguous, while in some of the provinces Acts on the statute books are inoperative. They also stipulate rules governing all classes of boilers. A rule that is applicable to a water-tube stationary boiler in some cases cannot be applied to a traction-engine boiler, and rules that apply to traction-engine boilers cannot be applied to water-tube or brick-set stationary boilers.

The mover of the resolution suggests that each of the provinces employ a thoroughly expert man, one who is conversant with the inspection and construction watertube, brick-set and traction and portable engine boilers, and that these experts meet at some convenient place and formulate a Boiler Inspection Act that will be uniform for the Dominion.

A Dominion Act would be preferable, but this is found to be unconstitutional, the provinces having control of these matters.

The Act should consist of rules, regulations, formulas, etc., for the construction of all steam boilers made or used in Canada, and rules for the inspection of these boilers in the field, under which Provincial Inspectors should work.

There should be a Chief Inspector for each province, and if though advisable a Chief Inspector for the Dominion, to whom manufacturers could submit blueprints and specifications of boilers to be passed on.

The new Act should not be retroactive. Boilers sold or in course of construction at the time, or previous to a certain date, should be inspected under previous Acts, or rules could be laid down in the new Act governing these boilers.

The Acts as they are at the present time are a great hardship to users as well as manufacturers. For instance, a person purchasing a boiler in one province could not use the boiler in some of the other provinces, as it would not comply with their Acts. This is also a hardship for manufacturers, as they have to make boilers of different construction for the different provinces.

We trust that you will have this matter taken up at your next meeting, as some of the provinces are now formulating Bolier Inspection Acts; and as the matter is a serious one, now is the time to rectify any mistakes in the Acts and see that they are uniform and that they protect both manufacturer and user.

Yours truly,
J. A. NELLES, Secretary.

This serves to show the interest that is being taken in obtaining uniform legislation. Engineers, manufacturers and the public generally are interested in it and the governments cannot refuse to pass legislation which is clearly for the country's good.

## ELECTRICAL PLANT AT NORTH HATLEY.

The Eastern Townships Electric Co., North Hatley, Que., have been making extensive improvements to their power plant on the Massawippi river.

These improvements consist mainly of removing the old open wood flume intake, upright wheel, crown gear, etc., and replacing them with new and improved bulk-head, to which is attached a pair of improved Crocker Turbines, set horizontally in an extended steel case, on stone and concrete foundations.

From the present power house site down stream a distance of some 700 or 800 feet, an additional 4 feet could be obtained, and to utilize this drop without a great deal of expense, a timber and stone crib breakwater was built, extending down stream about 800 feet, dividing the river from the tail-race, and made tight on the river side by plank battens and clay. The tail-race is being excavated to take in the full head, and when completed will mean a total head of 19 feet. With this arrangement the capacity of the plant will be practically doubled.

The turbines were made by the Jenckes Machine Co., Sherbrooke, and have been put in motion under a nominal head of 15 feet with partial load with highly satisfactory results.

F. C. Davis, formerly of Sherbrooke, has been the engineer in charge.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Electricity and Steam.

The Cranbrook, B.C., Electric Light Company, have decided to put in a new steam plant at a cost of $30,000 to $50,000.

G. C. Mason has secured the contract for the erection of the new transformer house of the Falls Power Co., at Welland.

The Cranbrook Electric Light Co., Cranbrook, B.C., have decided to put in a big steam plant at a cost of $30,000 to $50,000.

The contract for a motor generator set and switchboard panel for Vancouver was awarded to the Canadian Westinghouse Co.

The suggestion of Ald. Mills that $20,000 he raised hy dehentures for the distrihution of Niagara power was endorsed by the Ingersoll Fire, Water and Light Committee.

The city of Toronto will shortly call for eighteen electrically driven pumps, six for the main pumping station, eight for the high level station and four for the island pumping station.

The Colonial Engineering Co., have offered a proposition for the construction of Montreal's generating station for the purpose of lighting the streets at a cost not exceeding $40 per lamp a year.

The British Insulated and Helsby Cahles, Limited, have sold their Canadian interests to the Canadian British Insulated Co., Montreal, the latter firm taking over the whole of the former's business, including Toronto's contract for electric light cahles for the power distribution plant.

A special meeting of the directors of the Merchants' Light and Power Co., Montreal, was held recently at which it was decided to ask Messrs. Ross and Holgate, the experts who had charge of the installation of the municipal lighting plant in Westmount, to prepare plans for the electric plant of the company.

The property and huildings of the Olds Gas Power Co. at Saskatoon, has been purchased hy the Saskatoon Electrical Co., for the purpose of carrying on foundry work, machine shop, electrical work, pattern making and hlacksmithing. A company will be incorporated as the Saskatoon Electrical and Foundry works to carry on the work.

The Calgary Power and Transmission Co. will shortly commence a great work on the Horseshoe Falls on the Bow river, near Kananaskis. It is expected that the work will cost approximately $700,000. As soon as the contract is let the work will he commenced for the power plant to supply cheap power to Calgary. Smith, Kerry & Chace are the engineers in charge.

The Simcoe Railway & Power Co., is proceeding with the development of the Big Chute on the Severn river, thirty miles from Midland, Ont. A staff of engineers under the direction of C. H. and P. H. Mitchell, Toronto, have made extensive surveys at the site and along the route of the transmission lines. It is expected that about 4,000 horse power can he developed.

The purchase hy Montreal interests for several months past of the stock of the Quebec Railway, Light and Power Co., which recently gave the controlling interests to Montreal capitalists, interested in the Light, Heat and Power Co., has all along been understood to be the initial step to the amalgamation under the same management of the rival gas and electric light companies in Quebec.

A joint stock company is being formed to build dams at Gull and Long Lakes, in Addington county, to retain water for use by the power companies along the Mississippi river. The companies using the water for power uses will he assessed according to the benefits derived. It is said that this movement is the first step in the consolidation of all power companies at a future date.

The addition to the electric light station, in which will he placed the pumps for the Vancouver salt water system, is almost completed. The turhine pumps, which have heen manufactured hy the D'Olier Co., of Philadelphia, are expected shortly. There are two of them, one is to be operated by electric power, the other by steam. All the mains are laid and hydrants installed, so that when the pumps are in and in working order the additional fire protection will be an actual fact.

Rosedale residents, Toronto, are being canvassed hy Mr. G. E. Bradshaw, manager of the Dominion District Steam Heating Co., who are desirous of estahlishing a steam heating plant in Rosedale. The plan is to erect a plant and pipe the steam manufactured there under ground through the streets to the houses, where it will enter the pipes of the house heating system. It can he turned on and off at the meter just as gas is, and heat will he sold on the same plan that gas is sold.

The Vancouver Power Co., capitalized at $2,500,000, has given notice that on August 11 application will he made under the Water Act for a license in the New Westminster District. The company wish to divert a part of the Misliloet River, North Arm, Burrard Inlet, some 12 miles ahove the mouth of the river, for a water power plant for the purpose of generating electricity for mechanical, industrial and commercial purposes. The company wish some 800 cuhic feet of water per second for this plant.

The B. C. Electric Co., will make a big addition to its plant at Victoria, whereby additional power to the amount of about 750 horse power will he provided. The steam plant which was formerly in use at Vancouver, has been hrought to Victoria, and work on the erection of a power house will commence at once. The contract for the work has been let to Malcolm & Dinsdale. The cost of the erection of the power house and installation of the plant will be in the neighborhood of $50,000.

Sealed tenders addressed to the City Clerk, Saskatoon, will be received until five o'clock p.m., Tuesday, Aug. 24th, 1909, for the following:—"A"—1 8" steam separator, capahle of working continuously at 100 lbs. pressure, and standing cold water test at 210 lbs., and fitting in required position; "B"—1 500 H.P. open-faced boiler heater. Plans and specifications can he seen at the office of E. L. White, Electrical Superintendent, Chuhb Block, Saskatoon. William Hopkins, Mnyor; J. H. Truesdale, City Clerk.

The Erindale Power Co., which recently purchased the power station on the Credit River, of the Southern Light and Power Co., and also the land holdings at Port Credit harbor, will spend $100,000 on the construction of the dam and the erection of huildings for the machinery at the station, with a view to delivering 1,000 horse power to the distributors, the Stark Telephone, Light and Power Co., within six months. The York. County Loan Co., spent ahout $200,000 on the work. English capitalists are hehind the Erindale power scheme. It is said that suhsidiary companies will take over the Oshawa and Bowmanville holdings of the Stark Co.

On and after August sixteenth, plans and specifications may be seen, and, under proper restrictions, copies obtained by parties proposing to tender for the necessary excavation and the construction of main dam, headworks, power house, retaining walls, and erection of steel racks, penstocks, sluice gates, and other work necessary for complete construction of the Calgary Power & Transmission Company's works on Bow River, 45 miles west of Calgary. The preliminary work of railway spur, unwatering tunnels and cofferdam is now heing executed. The plans and specifications will be on view on nnd after the above date at the offices of the Company's Engineers, Smith, Kerry & Chace, Toronto, Winnipeg and Calgnry.

The Nipissing Power Co., is constructing a power plant on the South river, 19 miles south of North Bay, to supply North Bay and vicinity with electric power. The works include permanent concrete head works; 1-6 foot wooden stave pipe, 3,000 feet long, a steel stand pipe for more effective regulation; a concrete and brick power house, witn an equipment of two 450 K. V. A. generators, two 925 h.p. turhines. The transmission will be 22,000 volts with an aluminum transmission line circuit protected hy steel ground wire cahle. The step-up station will be equipped with three 300 K. V. A. single phase transformers 2,200—22,000 volts. The terminal station in North Bay will have three 450 K. V. A. single phase trnnsformers. The electrical equipment is heing supplied hy the Canadian Westinghouse Co., and the turhines by the Jenckes Machine Co. The president of this company is C. B. Smith, Esq.

Sealed tenders addressed to P. J. Hart, town clerk, Cohalt, will be received up to 8 p.m., on August 18, 1909, for the following work and materials:—1. Contract A.—Supplying cast iron pipe and special castings. 2. Contract B.—Supplying hydrants and valves. 3. Contract C.—Supplying steel stand pipe. 4. Contract D.—Supplying vitrified tile, pipe and junctions. 5 Contract E.—Supplying cast iron manhole covers. 6. Contract F.—Supplying lahor and certain materials for the construction of waterworks and sewers. 7. Contract G.—Supplying and erecting pumping machinery. Plans and specifications may be seen, and forms of tender procured at the offices of the Town Clerk, Cohalt; Sutcliffe & Neelands, Engineers, New Liskeard, and Galt & Smith, Consulting Engineers, 23 Jordan St., Toronto. The lowest or any tender not necessarily accepted. Dated 22nd July, 1909. P. J. Hart, Town Clerk.

W. E. Skinner, manufacturers' agent for electrical and mechanical specialties, Winnipeg, has been granted a franchise by the Winnipeg city council for the erection of a steam heating and distributing plant. A special by-law is heing prepared at present outlining the nature of the franchise. According to the proposed hy-law the concern will pay nothing for the franchise for the first three years, hut will pay 2½ per cent. on the gross receipts after that time, a hond of $25,000 will he issued guaranteeing the city against damage to the streets in the installation of the plant. Mr. Skinner has not suhmitted the plan of the station, and he is at present working up capital and organizing a company. The city council were quite duhious about the concern undertaking such a tremendous work, hut Mr. Skinner sufficiently impressed them with his sincerity and the feasibility of such an enterprise, and there is considerahle support given the idea in local circles.

The London Board of Directors of the British Columhia Electric Railway having voted to appropriate $2,500,000 for extensions and improvements to its system in Vancouver during the next twelve months, R. H. Sperling, general manager of the company, states that over half of the amount appropriated will be used for the construction of new tram lines in Vancouver. A new 10,000 h.p. water wheel and generator will be installed at the generating plant on the North Arm of the inlet at a cost of $250,000. A new dam will he erected at the mouth of Lake Coquitlam, to cost $200,000. Improvements will be made to the New Westminster interurban line between Vancouver and Central Park, which will involve an expenditure of ahout $200,000. The company will also equip the railway recently huilt by the Canadian Pacific Railway from New Westminster to Ehurne along the North Arm of the Fraser to be operated by electricity. Several other extensions are also contemplated hy the company.

### Trade Notes.

The Standard Engineering Co., have moved from 43 Scott St., to more commodious quarters at 47 Wellington St. east. The Standard Engineering Co. are agents for the American Stoker and mnnufacture the Standard-Crown glohe and check valves.

### Municipal Enterprises.

Stirling, Ont., is to vote on a by-law to spend $10,000 for electric light purposes.

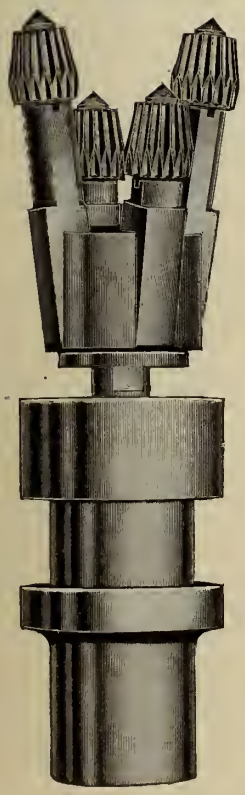
The finance committee of Stratford's city council has been authorized to offer $30,000 for the electric light plant and equipment there.

The Richmond, B.C., council will provide $125,000 towards the $359,000 necessary for the waterworks extension from Coquitlam lake. The balance of the expense is heing met hy the city of New Westminster. Richmond will also have to spend $150,000 for distrihution, installation of pipes, etc.

Lindsay has a mortgage of $1,500 on what is known as the Burleigh Falls Power, and G. H. Hopkins, K.C., has heen instructed to look up the old agreement with a view to securing the power for Lindsay. Recently the company asked $150,000 for the Burleigh Falls Power, and the city of Peterboro made them an offer of $50,000. The offer is laughed at by the company.

Clinton's, Ont., water works committee have nwarded contracts for water works as follows: Pipe laying, T. M. Cullen, Huntsville, prices ranging from 18 cents to 30 cents per foot, cast iron pipes nnd special castings, Gartshore, Thompson Co., Hnmilton, $32.20 per ton; construction of 80-foot stand pipe and foundation, Hunter Bridge & Boiler Co., Kincardine, $5,000.

# "LIBERTY"
## Power Plant Trouble-Killers



"CYCLONE" CLEANER

## "CYCLONE" TUBE CLEANER

The "CYCLONE" is easily the Peer of all other Tube Cleaners. It forces its way through any thickness of scale and does the work in less time and in a more thorough manner than **any other tube cleaning device.** It restores the tubes to the same efficiency they had when new.

Operated by either air or steam, sixty pounds pressure being ample for the most strenuous work.

The "HEAVY DUTY" CLEANER is operated by water and is designed for removing any thickness of scale. It is the King of all Cleaners of this type. Manufactured from a solid piece of machine steel, it is practically indestructible. Equipped with the Norivet Head and Liberty Drills.

The "TWIN STRAINER" removes all solid matter from water and other liquids. The Twin is invaluable on lines where continuous service is a necessity, as one side can be cleaned while the other is working, thus preventing the annoyance and expense of a shut-down.

HEAVY DUTY CLEANER

## The "Liberty" Greenaway Oil Separator

utilizes gravity as a separating medium, and removes all oil from steam. It can be cleaned without breaking pipe connections.

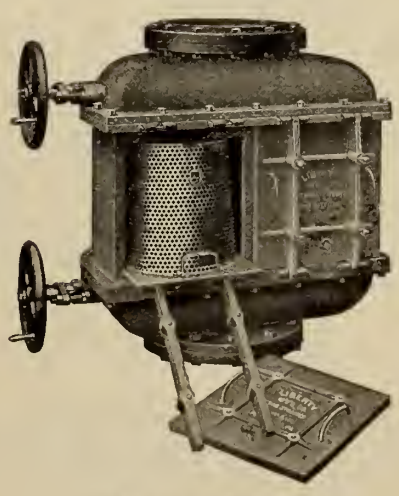
OIL SEPARATOR

**WRITE FOR OUR COMPLETE CATALOG**

# The Liberty Manufacturing Co.

6902 SUSQUEHANNA STREET,

Pittsburgh, Pa.



TWIN STRAINER

The city of Collingwood has entered into a contract with the Canada Foundry Co. to instal a Premier Gas Engine and a Canada Foundry Producer. The engine is a 4-stroke Otto cycle type of 100 h.p. The gas producer is suction gas type. The plant is guaranteed by the company to produce 75 to 100 h.p. at a full consumption of 1¼ tons of coal per h.p. The tenders were Hornsby, Stockport, $7,510 ; Campbell Gas Engine Co., $6,867 ; Croshy Engine Co., $5,850, and Canada Foundry Co., $5,550.

### Large Gas Engine Contract.

The Colonial Engineering Co., 222 St. James St., Montreal, bas just closed a contract witb the Dominion Light, Heat & Power Co., for a 1,000 H.P. Hornsby-Stockport Gas Engine equipment, to be installed in the city, for the purpose of public and private lighting, and the sale of current for power. Tbe Dominion Light, Heat & Power Co. was granted, at the last session of the Quebec Legislature, a franchise under which they will be able to sell electric current for all purposes.

The equipment will consist of tbree 250 H.P. Twin Cylinder Hornsby-Stockport Gas Engine Units and two 125 H.P. units. The station will be the most modern one of the kind in the Dominion, if not on the continent, the building to be of concrete construction throughout, and 3-phase, 60 cycle alternating current will be generated. Under the contract between the Colonial Engineering Co., and the Dominion Light Heat & Power Co., this plant is to be in operation by December next, and considering the fact tbat the Colonial Engineering Co. has already made fourteen very successful installations in the Dominion, it is expected that this plant will be a success in every respect, and, when completed, will attract the attention of the engineering fraternity not only in Montreal and Canada but from elsewbere.

Anthracite pea coal, coke or charcoal will be the available fuels.

It is understood that a number of very prominent Montreal capitalists are behind the enterprise, and in view of the proposition which tbe Colonial Engineering Co. recently put before the city council of Montreal concerning the cost of its street lighting and what the Colonial Engineering Co. is prepared to do, the installation, operation and results obtained in this 1,000 plant will be watched with great interest.

This is by far the largest gas engine contract for lighting and power purposes that has yet been consummated in Canada.

### Cobalt Power.

The Mines Power, Ltd., Cobalt, is constructing an 11,000 h.p. power plant on the Matabitchouan river, 24 miles southeast of Cobalt, at a point where the river has a fall of 300 feet. The construction consists of a concrete dam, 10,000 cubic yards, which will create a large storage in the Bass lakes, besides several other storage dams for other lakes. The pipe lines consist of two steel pipes 5 feet in diameter, and the power plant operates under a net working head of 300 feet.

The power equipment is being manufactured by the Allis-Chalmers-Bullock Co., Montreal, and consists of four units of 1,500 k.w. each, normal rating and four turbines of 2,750 h.p. each, at 600 r.p.m., and two Pelton driven exciters. The governors are being supplied by Jens Orten Boving of Sweden.

The transmission system consists of four three-phase, step-up transformers, 1,875 K.V.A. each, and three substations, one at Cobalt, Kerr Lake, and South Lorraine, each consisting of four three-phase transformers of 1,250 K. V. A., 375 K. V. A. and 312 K. V. A. respectively.

The Canadian Westinghouse Co., are supplying the transformers. The transmission is at 44,000 volts and will be carried over two 3-phase circuits on separate pole lines over a right of way 135 feet wide. Each circuit will be protected by a steel ground wire cable and there will be a telephone system of one pole line. The transmission cable will be No. 00 aluminum, supplied by the Northern Aluminum Co. Power will be supplied to the mines of Cobalt. The president of the company is E. A. Wallberg. The transmission line is being erected by the Standard Construction Co., Montreal. Smith, Kerry & Chace, Toronto, are the engineers in charge.

### "Rival" Engines Change Hands.

J. T. Schell has now a complete chain of agencies extending from Halifax to Vancouver.

J. T. Schell, Alexandria, Ontario, has acquired tbe right from the Laurie Engine Co., to manufacture their line of "Rival" horizontal engines.

Work will be begun at once on the small sizes 15, 20, 27 horse power, but later on their machine shop and foundry at Alexandria will be extended to enable the larger sizes to be built.

These engines will be remodelled somewhat and will embody several well defined improvements and together with tbe "Auto-Climax" engines of 5 and 10 horse power will make a very complete line.

# Power Supply Markets

## VANCOUVER.

Building is going steadily on, making plenty of work. Those who make a specialty of builders' materials find that department particularly busy.

With the object of saving money, the water committee of tbe city council has bad estimates prepared of the needs of the waterworks system for the next two years, instead of for tbe next year only. The amount is $370,132, and includes 4,000 new services ; 200 new hydrants ; 30 miles six-inch mains and laying ; 15 miles eight-inch mains ; 5 miles 12-inch mains ; 2 miles four-inch mains ; new valves.

The Western Canada Power Company, formerly the Stave Lake Power Company, is calling for tenders, locally, for the four big bellmouths for tbe intake dam at Stave River Falls. These pipes will be the largest of the kind in Canada, tbe diameter of each on tbe upstream side of the works being 17 feet, tapering to 14½ feet. Several local firms are tendering for the work.

## VICTORIA.

Development work on Vancouver Island is going on in good shape. Sawmills are being erected, coal mines opened and other work being done at places which were bitberto unknown and business generally is good. A party of officials of the Pacific Coast Mines Co. visited Coal Harbor and witnessed the taking on of cargo and bunker coal on the Jebsen steamer "Erna." Several small shipments have been made previous to this, but not until recently has the company been in shape to use its full facilities for londing the output of the mines. The work that is being done by this new company was a revelation to those who made the trip. At Coal Harbor the most modern machinery has been installed for the rapid handling of coal. Bunkers have been built with a capacity of 5,000 tons. By a system of conveyor belts the coal is carried in a continuous stream into the hold of vessels. The company have constructed a standard gage railway from their mines to the harbor, a distance of about eight miles. At present 600 tons a day are being turned out with plenty more in sight. Tbe company is offering no stock for sale, on the contrary its finances were long ago provided for, and it is now a matter of steady development.

Work has commenced on the installation of the Ladysmith Electric Lighting plant. The machinery is commencing to arrive, and it is expected that the light will be ready for the consumer in about two months.

## TORONTO.

The trade in steam specialties is good and dealers in these lines are talking very enthusiastically about Canadian trade. A number of new makes are being widely advertised and are finding a ready sale. Some large orders for steam traps have been reported as well as valves, unions, flanges, etc.

Prospects are that there will be a rise in price in rubber belting, gaskets, rubber packing, etc. The price of crude rubber has advanced to a point very much beyond that ever reached before. About a year ago fine Para rubber was 80 cts. per lb. It has reached $1.92 and $1.95 per lb. in New York. Nearly all the ingredients used in the manufacture of rubber goods has also advanced materially. Preliminary advances have been made by Canadian manufacturers of rubber goods, including belting, packing, etc. Manufacturers generally are compelled to advance the price and unless there is an easing of the market, still further advances will be necessary.

The demand for electrical machinery and supplies continues brisk, the municipalities keeping up the demand. There appears to be a wave of municipal passing over Canada and as a result a great number of towns, which heretofore had not considered the question, have now taken the matter in hand and placed orders for lighting and water plants. Conspicuous by their number are the towns and cities of western Canada. Orders include machinery built in Canada, United States, England and Sweden.

One thing that shows the state of trade is the fact that the Union Petroleum Co., Buffalo, have had to purchase 80 miles of second hand pipe to carry oil from Chatham to Sarnia. This pipe purchased from the National Supply Co., Pittsburg, was made some 20 years ago and was laid in the Fort Wayne field of Ohio two years later. The pipe ranges from three to ten inches, and is in a perfect state of preservation.

Only two companies bid on the order, the National Tube Co., and the Wheeling Iron & Steel Co. Had this bid been put out last year every pipe-making concern in the country would have put in a bid on it. As deliveries had to be commenced during the week, the Buffalo company purchased second-hand iron pipe instead of new steel pipe.

BOILER TUBES—Orders are about the same. Lap welded steel per 100 ft., 2-inch, $8.50 to $8.75 ; 2¼-inch, $10 to $10.75 ; 2½-inch, $10.75 3-inch, $12.00 ; 3½-inch, $15, and 4-inch, $18.50 to $19.00.

BELTING—Orders are good and prices firm. Prices of leather belting is stationary but a rise in rubber belting is expected immediately.

LEAD WOOL—Demand good. Price stationary at $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35 ; American, $27.50 to $35 per 1,000.

## CATALOGUES.

MOTORS—The Phoenix Bulletin, issued by the Phoenix Dynamo Manufacturing Co., Ltd., Bradford, illustrates different types of their machines, as :—D. C. and 3 phase generators, motors and motor-generators and also the application of Phoenix motors to various classes of machinery.

PIPE FITTINGS—Bulletin 210 from the Sight Feed Oil Pump Co., Milwaukee, Wis., describes the Union-Cinch Fittings and give the price list of same up to 1" iron pipe size.

RENEWO VALVES—Pamphlet from the Lunkenheimer Co., Cincinnati, describing their Renewo valves with renewable seat and disc. The special features are fully illustrated.

UNIONS—Booklet from Dart Union Co., Toronto, entitled "Leaks," tells of the cause of leaks and their cure.

WING TURBINE BLOWER—Pamphlet from Russell & Gifford, 505 Pearl St., Montreal, Canadian manufacturers of the Wing Turbine Blower. The blower is fully described and illustrated.

AUTOMATIC REGULATING DEVICES—Catalogue 55 of Mason Automatic Regulating Devices for pumps from Peiler & McKenzie, 52 St. James St., Montreal. Mason governors, steam pump pressure regulators for hydraulic service, relief valves, vacuum pump regulator, etc., are described and illustrated.

GOLDIE CORLISS STEAM ENGINES—Illustrated catalogue No. 18 on coated paper from Goldie & McCulloch, Galt, describes their Heavy Duty Goldie Corliss Steam Engines. A number of excellent half-tones show illustrations of these engines. A copy of the catalogue will be sent for the asking.

RUBBER GOODS—164 page catalogue from Quaker City Rubber Co., Philadelphia, giving a full description with illustrations of their many lines, including belting, packing, fire hose, etc. A number of handy rules in regard to power transmission are included, making the volume a handy book of reference.

HEATERS—Illustrated bulletin No. 19 from Goldie & McCulloch, Galt, describes their Ideal, Tubular and Copper Coil Heaters. Dimensions of these heaters are given in full.

GAS ENGINES AND PRODUCERS—Goldie & McCulloch, Galt, have issued a full description of their new gas engine and gas producer in catalogue form. A copy will be sent on request.

## BOOK REVIEWS.

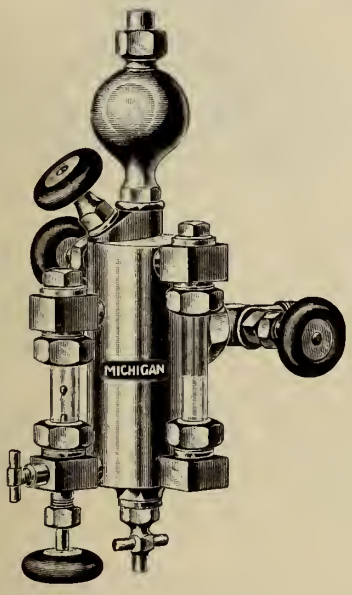
STEAM POWER PLANT PIPING SYSTEMS—By William L. Morris, M.E. Published by the McGraw-Hill Book Co., New York. 490 pages, 6 x 9 ins., illustrated. Price $5 net.

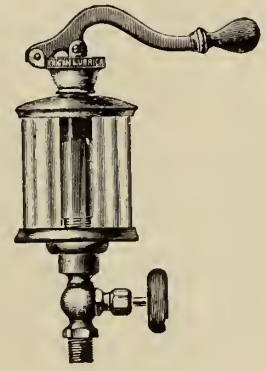
This book treats of such parts of the power plant relating to piping. All auxiliary apparatus in the pipe line between the boiler and engine and in the various systems for steam, oil, air, etc., are taken up and their general design discussed.

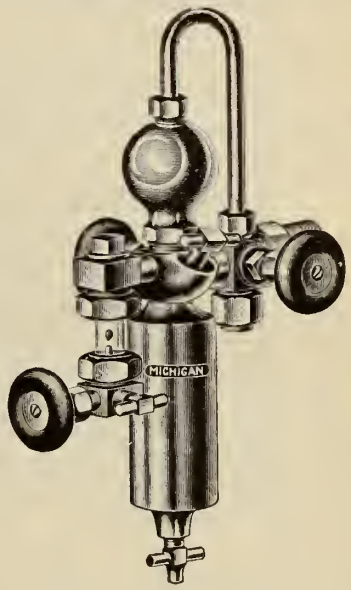
There are thirty-one chapters, each taking up a different phase of the subject. Chapter 1 takes up Origin of Improper Piping, 2 Piping Diagrams, 3 Piping Systems, 4 Condensers and Heaters, 5 Live Steam Drips, 6 Blowoff and Exhaust Piping, 7 Air and Oiling Systems, 10 Live Steam Details, 11 Vacuum Exhaust Details, 13 Boiler Feed Details, 26 Steam Drip Details, 27 Oil and Drip Piping Details, etc.

This will give the reader an idea of the comprehensive way in which the sub-

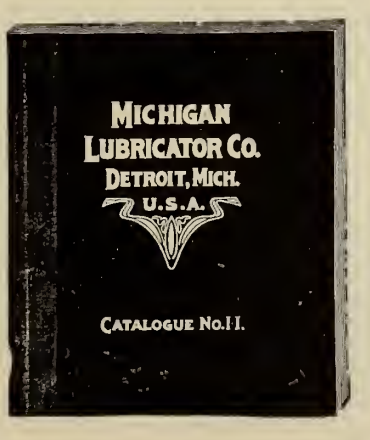
# MICHIGAN



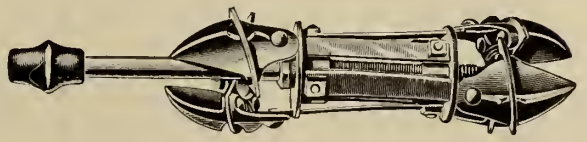


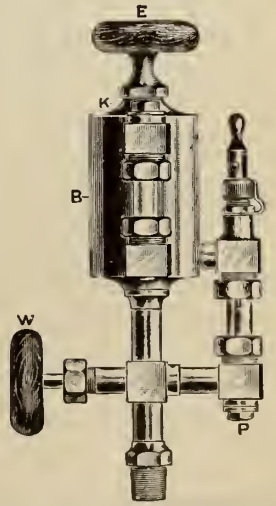

ILLUSTRATED CATALOG




MAILED TO YOU FREE

WRITE TO-DAY






## MICHIGAN LUBRICATOR CO.

DETROIT, MICH.

# ELECTRIC BARGAINS

**We have some GOOD, PRACTICALLY NEW, MOTORS GOING AT A SACRIFICE**

We manufacture alternating and direct current motors in all sizes also sell Century single phase motors in all their sizes. Repairs promptly and cheaply performed.

**JONES & MOORE ELECTRIC CO., Limited**

294-300 Adelaide St. West Toronto, Ont.


## MISCELLANEOMS.


AN EXTRA 1 PER CENT. PROFIT.—A National Cash Register will earn at least an extra one per cent. profit for any retail merchant. The National Cash Register Co., F. E. Mutton, Canadian Manager, cor. Yonge St. and Wilton Ave., Toronto, Ont.

ACCURATE COST KEEPING IS EASY if you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe s time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited. Office and factory, 27 Alice Street, Toronto. (tf)

CUT DOWN YOUR PRINTING BILLS one half by installing a "Writerpress." Your office girl or boy can with it print your circulars, price lists, etc., at the rate of 1500 to 2000 copies per hour. Best machine ever made for printing facsimile typewritten letters. Prints from printers' type, half-tones, etc. Retail stores could greatly increase their business by using a Writerpress to run off circulars and letters, sending them out to their customers and probable customers announcing special sales, etc. Send for illustrated catalogue and samples. The Canadian Writerpress Company, 33 John St. South, Hamilton, Ont. (tf)

ELLIOTT-FISHER STANDARD Writing Adding Machines make toil easier. Elliott Fisher Limited, 513, No. 83, Craig Street W., Montreal, and 129 Bay Street, Toronto.

NOTICE!!—Users of Pitner Gasoline Lamps are warned against being induced to purchase parts of other makes of lamps to be used on the Pitner. The most vital part of any lamp is its generator and the Pitner Generator has been granted a patent in Canada, the United States and other countries, on the principle of its improved method of generating gasoline vapour. Supplies and parts or the Pitner Lamps can be received by return mail by applying to our representatives or direct to THE PITNER LIGHTING CO., Limited, 36-38 Lombard St., Toronto, Ont. (tf)

SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling, and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

WANTED—A splendid opportunity for dealers to handle the best combination Duplicating, Addressing and Office Printing Machine on the market. Exclusive territory. Send name and address, giving occupation and references, to the Canadian Writerpress Company, Ltd., 33 John St., Hamilton, Ont. (tf)

U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD


ject is treated. Another subject covered is City Water Piping, making the volume very complete. It is a useful book of reference which should be in the library of every progressive engineer.

POPULAR ELECTRICITY—By Walter Hibbert, F.I.C., F.C.S., A.M.I.E.E. With about 200 illustrations in the text. Cassell & Co., Toronto. $1.25 net.

So many industrial occupations are now invaded by electrical methods that a certain familiarity with the surface working is quite common. Popular interest has therefore deepened, and requires more detail for its satisfaction than was formerly the case. This volume is written for those who would like to know more than is commonly offered to them, and gives a bird's-eye view of the many applications of electric energy.

Mr. Hibbert, who is well known in connection with his extremely successful classes on engineering, has written a book dealing with electricity from a popular point of view. In its pages the student of electricity will find all the practical knowledge which he requires. The ordinary reader will be not less interested in the careful and illuminating descriptions which Mr. Hibbert gives of the uses to which electricity is now put.

Popular Electricity has been brought up to the moment in the matter of timeliness. It includes, for instance, Wireless Telegraphy, Wireless Telephony, Electricity as applied to Automobiles, descriptions of the very newest forms of incandescent lamps—tantalum lamps, tungsten or osram lamps,—Roentgen Rays, and a section dealing with Radium in its electrical aspect.

HYDROELECTRIC DEVELOPMENTS AND ENGINEERING—By Frank Koester, Consulting Engineer, Assoc. Mem. Am. Inst. E. E.; Mem. Soc. German Engs. (Berlin), author of "Steam-Electric Power Plants." Published by D. Van Nostrand Co., 23 Murray St., New York. 454 pages, 7 x 10 ins., 500 illustrations. Price $5.00 net.

Hydroelectric Developments and Engineering is a practical and theoretical treatise on the development, design, construction, equipment and operation of hydro-electric transmission plants. The book is divided into three sections: 1 The transformation of water power into electrical energy; 2, the transmission of high tension electrical current; 3, modern American (including U.S. and Canadian) and European hydro-electric developments.

The subjects covered include a chapter on hydraulics, dams, conduits, turbines, generators, switchboard equipment, towers, transformers, etc. An index is also given of the illustrations.

The practice in America, and Europe is given and the novel features of hydraulic, mechanical and electrical engineering are pointed out. Some of these are air-shafts and equalizing chambers in connection with pressure tunnels; impulse wheels with draft tubes and multiple, non-water-wasting nozzles; compound turbine on a single shaft, the discharge of one being the supply of the other; unique combination of single and three-phase high-tension transmission systems from three-phase generators, etc. Consulting engineers, manufacturers, promoters and students will find the volume a systematic and comprehensive treatise on hydro-electric work.

INTERNAL COMBUSTION ENGINE—By H. E. Winperis, M.A. (Cantab), Assoc. M. Inst. C.E., Assoc. M. I. E. E. Published by Archibald Constable & Co., 10 Orange St., Leister Sq., London, W.C., Eng. 326 pages, 5 x 8½ ins. Illustrated. Pricca 6s. net.

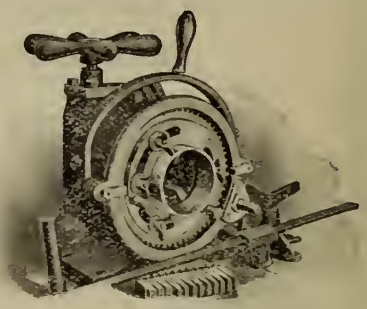
It is a text-book on Gas, Oil and Petrol Engines for the use of enbineers and students. The book deals with the design and working of internal combustion engines. It is of necessity mathematical in parts, but these are for the most part printed in smaller type so that readers may omit these parts in the first reading. The book has taken up some new phases of the subject.

Scattered through the book are problems to be solved. There are nine chapters covering the subject fully. The book will assist the reader to an understanding of the applications of those heat engines which work on the internal combustion principle and a perusal will give the practical engineer a grasp of the principles concerned in the design and working of gas, oil and petrol engines.

PROCEEDINGS UNDERGRADUATE SOCIETY—Published by the Canadian Engineer, Toronto, 77 pages, 6 x 9 ins., illustrated. Price 25 cts.

The book contains addresses before the Undergraduate Society of the Faculty of Applied Science, at McGill University, of Montreal. These include six papers, the Relation of the Engineer to the Community; Description, Instalation and Economy of $CO_2$ Recorders; Value of Gas Power, etc.


## Suppose You Pay Two Dollars a Day

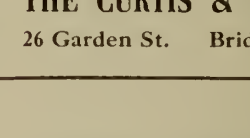


THE old stock and die way requires four men where our pipe cutter and threader, whether run by hand or power, demands only one operator. Better, easier, quicker work with a wider range and a clear saving of six dollars a day. Circular?

**THE CURTIS & CURTIS CO.**

26 Garden St. Bridgeport, Conn.

DYNAMO-ENGINE-SETS
FUEL-OIL- GASOLENE-ALCOHOL




THE BUFFALO MECHANICAL AND ELECTRICAL LABORATORY.

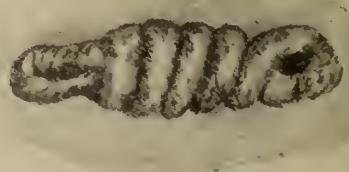
ERIE COUNTY BANK BLDG., BUFFALO, N. Y., U. S. A.

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.

"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

# Would $4.20 Pay for the Repairs to Your Grates for the past 2 YEARS?

Yet this amount is the only expense for repairs that the Belgo-Canadian Pulp & Paper Co. have had on the Venetian Grates with which we furnished them for a 212 H.P. boiler nearly two years ago.

Just think this over. Only $2.10 per year, and the grates in continuous use day and night during that time, and no artificial draft as previously required.

Another point: You can burn Anthracite screenings at $1.85 per ton and get a flame 8 feet long; there is NO SMOKE, and there is a large saving in fuel.

The reason is simple: 'Tis all in the construction, which is as simple as the reason. Let us tell you more about these grates.

**The Canada Gas Power & Fuel Co.,** 68 St. James St. **Montreal**

If you have Joint Troubles,
If you have New Pipe Lines to erect,
If you have Superheat, Moisture, Oil, Gas, Water or Acid to care for,
In a word if you have Pipes (screwed or flanged),
Cylinders, Receivers, Economisers, Heaters, Radiators, etc. in use, you require

HAWKINS' IMPERISHABLE JOINTING CEMENT

Send for Booklet and Prices.

BAIN & MITCHELL, Y.M.C.A. Building, MONTREAL

Sole Canadian Agents for

W. T. HAWKINS & CO., HUDDERSFIELD, ENG.

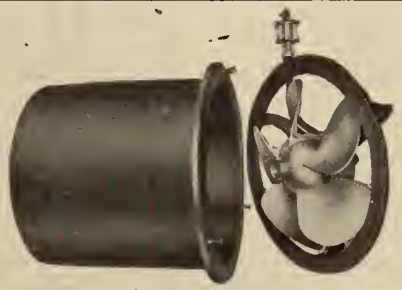
# Switch Board Parts

## Bulletin 3A—Just Out.

SEND FOR COPY.

**The Hill Electric Switch & Mfg. Co., Ltd.**

1560 St. Lawrence Street, - Montreal



SIDE VIEW

IF YOU WANT TO BURN **CHEAPER FUEL** OR DEVELOP **MORE POWER** You should buy

# THE TURBO-BLOWER

The most EFFICIENT and ECONOMICAL means for supplying MECHANICAL DRAFT to boilers

A few reasons why:

IT DELIVERS THE MOST AIR for the least possible amount of steam.
ITS CONSTRUCTION is the simplest and most suitable for the boiler room.
A BREAKDOWN is impossible because all the motive parts are enclosed.
NO WASTE OF POWER, the exhaust steam being used under the grates.
NO ATTENTION IS REQUIRED except filling the oil cup when needed.
ITS INSTALLATION is very simple and can be made by any mechanic.
THE LOW COST places it within the reach of every power user.

Catalogue and Description on request

TURBO-BLOWER CO., 30 Church Street, NEW YORK, N.Y.

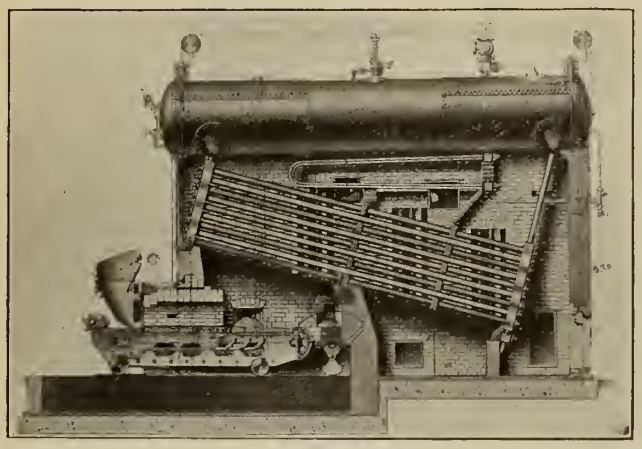
Canadian Representative: W. H. ADAMS, 102 Nazareth Street, MONTREAL, QUE.

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY OVER 7,000,000 H.P. IN USE



Babcock & Wilcox Patent Water-Tube Boiler, Superheater, and Mechanical Stoker

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and ELECTRIC CRANES

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING

# POWER. EQUIPMENT. STEAM.

### GAS & GASOLINE ENGINES

1 new 35—40 H.P. horizontal gas engine.
1 refitted 25 H.P. marine gasoline engine.
1 new 25—32 H.P. horizontal gas engine.
2 new 15—18 H.P. horizontal gas engines.
1 new 13—16 H.P. horizontal gas engine.
1 refitted 14 H.P. horizontal gasoline engine.
1 refitted 12—14 H.P. horizontal gasoline engine.
1 refitted 10—12 H.P. horizontal gasoline engine.
1 refitted 10 H.P. vertical gasoline engine.
1 new 8 H.P. horizontal portable gasoline engine with saw rig.
2 refitted 8 H.P. horizontal gasoline engines.
1 new 6—7½ H.P. horizontal gasoline engine.
2 new 6 H.P. horizontal gasoline engines.
1 refitted 6 H.P. vertical gasoline engine.
1 refitted 6 H.P. horizontal gasoline engine.
1 new 6 H.P. marine gasoline engine.
1 refitted 4—5 H.P. horizontal gasoline engine.
1 new 3½ H.P. marine gasoline engine.
1 refitted 3 H.P. vertical gasoline engine.
1 refitted 3 H.P. horizontal gasoline engine.
1 new 1½ H.P. marine gasoline engine.
1 new 1½ H.P. gasoline pumping engine.
1 refitted 1½ H.P. vertical gasoline engine.

### MOTORS & GENERATORS

1 92 H.P. Westinghouse, 200 volts, alternating current with transformers.
1 50 H.P. Jones & Moore, 220 volts, alternating current with transformers.
1 15 H.P. Jones & Moore, 250 volts direct current.
1 12 H.P. Consolidated, 250 volts, direct current.
1 8 H.P. Consolidated 250 volts, direct current.
1 7 H.P. Jones & Moore 250 volts, direct current.
1 5 H.P. Gee, 250 volts, direct current.
1 2 H.P. Jones & Moore, 500 volts direct current.
1 2 H.P. Jones & Moore, 110 volts direct current.
2 100 K.W. Canadian General, direct current generator.
1 160 K.W. Canadian General alternating current generator.
2 60 K.W. Jones & Moore, direct current generator.
1 30 K.W. Jones & Moore, direct current generator.
1 30 K.W. Jones & Moore, direct current generator direct connected to Robb-Armstrong engine.

### ENGINES & BOILERS

1 10"x11" Abell portable engine and boiler.
1 9"x12" Nagel, portable engine and boiler.
1 8"x12" semi-portable engine and boiler.
2 7"x10" Champion portable engines and boilers.
1 7"x10" Waterloo portable engine and boiler.
2 5½"x7" vertical engines and boilers.

### AUTOMATIC ENGINES

1 refitted 12"x30" R. or L.H. Corliss.
1 refitted 12"x28" R. or L.H. Corliss.
2 refitted 12"x12" Robb-Armstrong.
1 refitted 9"&16"x12" Ball-tandem.
1 refitted 12"x10" Westinghouse-Junior.
1 refitted 10"x10" Leonard-Peerless.
1 new 10"x15" Jewel.
1 refitted 10"x24" L. H. Brown.
1 refitted 9"x24" R. H. Wheelock.
1 refitted 8"x24" L. H. Wheelock.
1 refitted 8"x24" R. H. Brown.
1 refitted 7"x10' Leonard-Ball.

### HORIZONTAL ENGINES

1 refitted 16"x24" L. H. rocking valve.
1 refitted 11¼"x14" L.H. slide valve.
1 new 12"x15" C.C. slide valve.
1 refitted 12"x12" C.C. slide valve.
1 new 11"x15" C.C. slide valve.
1 refitted 10¼"x16" R.H. slide valve.
1 new 10"x15" C.C. slide valve.
1 new 10"x12" C.C. slide valve.
1 refitted 8"x10" L.H. slide valve.
1 refitted 8"x13" R.H. slide valve.
1 refitted 8"x12" R.H. Rocking valve.

*OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST*

# H. W. PETRIE, Ltd., Toronto, Montreal, Vancouver

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co , Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. D. McArthur, Brockville
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

W. H. Adams, 102 Nazareth St., Montreal, Que.
Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Canada Chemical Mfg. Co., London
Hygienic Laboratories, Toronto
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto
Morehead Mfg. Co., Detroit, Mich.

## Boiler Feed Pumps.

Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Michigan Lubricator Co., Detroit
Wm. B. Pierce Co., Buffalo

## Boilers.

Babcock & Wilcox, Montreal
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Canners' Machinery.

J. C. Wilson & Co., Glenora, Ont.

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Canada Chemical Mfg. Co., London

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Walter J. Francis, Montreal.
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
Moore & Scollan, Toronto
John B. McRae, Ottawa
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenora, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo, N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Mechanical & Elec. Lab., Buffalo
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co , Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Peterboro Lubricator Mfg. Co., Peterboro

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Packard Electric Co., St Catharines

## Lead Wool.

John Garde & Co., Toronto.

**Lubricators, Force Feed.**

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Sight Feed Oil Pump Co., Milwaukee, Wis

**Maple Cogs.**

J. C. Wilson & Co., Glenora, Ont.

**Mechanical Stokers.**

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

**Meters, Water and Electric.**

Peiler & MacKenzie, Montreal

**Mill Machinery.**

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg. Co., Lindsay, Ont
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

**Mining Machinery.**

Allis-Chalmers-Bullock, Ltd., Montreal

**Motors.**

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

**Oilers, Gang.**

Sight Feed Oil Pump Co., Milwaukee, Wis

**Oil Filters**

Darling Bros., Montreal

**Oil Separators.**

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

**Oils, Lubricating.**

The "Skaleoff" Co., Montreal, Que.

**Packing Leather.**

Detroit Leather Specialty Co., Detroit

**Packing, Metallic.**

Rhodes Improved Metallic Packing Co. Montreal

**Panels, Electric**

Hill Electric Switch Co., Montreal

**Perforated Metals.**

Allis-Chalmers-Bullock, Ltd., Montreal

**Pipe Cutting and Threading Machines.**

Curtis & Curtis Co., Bridgeport, Conn.

**Pipe Threading Tools.**

Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

**Piping, Steam,**

Babcock & Wilcox, Montreal

**Planimeters.**

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

**Plate Work.**

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

**Polish, Metal,**

G. W. Hoffman, Indianapolis

**Power Pumps.**

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

**Power Transmission Machinery.**

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

**Processing Retorts.**

J. C. Wilson & Co., Glenora, Ont.

**Pulleys, Iron.**

J. C. Wilson & Co., Glenora, Ont.

**Pumping Machinery.**

Allis-Chalmers-Bullock, Ltd., Montreal

**Pump Governors.**

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

**Pump Strainers.**

Canadian Steam Boiler Equipment Co., Toronto

**Pumps, Air,**

Lunkenheimer Co., Cincinnati, Ohio

**Pumps, Oil.**

Sight Feed Oil Pump Co., Milwaukee, Wis

**Reducing Wheels.**

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

**Safes.**

Goldie & McCulloch Co., Galt.

**Safety valves.**

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

**Shafting.**

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,
J. C. Wilson & Co., Glenora, Ont.

**Shaking and Dumping Grate**

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

**Smoke Consumers.**

Canadian Steam Boiler Equipment Co., Toronto
The "Skaleoff" Co., Montreal, Que.

**Smoke Stacks.**

Babcock & Wilcox, Montreal

**Special Machinery.**

Electrical Maintenance and Repair Co. Toronto.

**Sprocket Wheels.**

J. C. Wilson & Co., Glenora, Ont.

**Spur Wheels.**

J. C. Wilson & Co., Glenora, Ont.

**Steam Pumps.**

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

**Steam Separator.**

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto

**Steam Specialties.**

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

**Steam Traps.**

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Morehead Mfg. Co., Detroit, Mich.
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

**Switches, Electric**

Hill Electric Switch Co., Montreal

**Superheaters, Steam,**

Babcock & Wilcox, Montreal

**Switchboards, Light and Power.**

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co., Montreal

**Tanks, Blow-off**

Darling Bros., Montreal

**Tanks, Oil.**

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

**Tests and Inspections.**

Bain & Mitchell, Montreal

**Transformers.**

Allis-Chalmers-Bullock, Ltd., Montreal

**Transmission Machinery.**

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

**Tubes, Boiler,**

Babcock & Wilcox, Montreal

**Turbine Water Wheels.**

Allis-Chalmers-Bullock, Ltd, Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

**Turbines, Steam.**

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

**Unions**

Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio

**Vacuum Drying and Impregnating Apparatus.**

J. P. Devine Co., Buffalo, N.Y.

**Vacuum Governors.**

Canadian Steam Boiler Equipment Co. Toronto

**Vacuum Pans.**

J. P. Devine Co., Buffalo, N.Y.

**Vacuum Pumps.**

Canadian Steam Boiler Equipment Co., Toronto
J. P. Devine Co., Buffalo, N.Y.

**Vacuum Regulating Valves.**

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

**Vacuum Traps.**

Morehead Mfg. Co., Detroit, Mich.

**Valve Reseating Machines**

Darling Bros., Montreal

**Valves.**

Canadian Steam Boiler Equipment Co., Toronto
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Standard Engineering Co., Toronto.

**Vaults & Vault Doors.**

Goldie & McCulloch Co., Galt.

**Water Purifiers.**

Babcock & Wilcox, Montreal

**Water Softeners.**

Babcock & Wilcox, Montreal

**Watt Meters.**

Gas & Electric Power Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


## A

Allis-Chalmers-Bullock ..... inside front cover

## B

Babcock & Wilcox ..... 54
Bain & Mitchell ..... 53, 58
Beauhien, De Gaspe ..... 58
Borden-Canadian Co ..... 15
Brownell Co ..... 3
Buffalo Mechanical and Elec. Lab ..... 52
Butterworth Foundry Co ..... 5

## C

Canada Chemical Mfg. Co ..... 7
Canada Gas Power & Fuel Co ..... 53
Canada Metal Co ..... 64
Canadian Assn. Stationary Engineers ..... 63
Canadian Steam Boiler Equipment Co ..... 5
Corbet Boiler & Machine Co ..... 62
Curtis & Curtis ..... 52

## D

Darling Bros ..... 9
Dart Union Co ..... 6
Death & Watson ..... 58
Detroit Leather Specialty Co ..... 12
Devine, J. P., Co ..... 59
Diamond Grate Bar Co ..... 4
Dominion Belting Co ..... 10
Dunlap Tire and Rubber Goods Co ..... 12
Dymond Gas and Engine Co ..... 62

## E

Electrical Maintenance & Repair Co ..... inside back cover

## F

Farmer, John T ..... 58
Featherstonhaugh ..... 58
Francis, Walter J ..... 58

## G

Galt & Smith ..... 58
Garde, John, & Co ..... 52
Goldie & McCulloch Co ..... 16
Goodhue, J. L., & Co ..... 10
Goold, Shapley & Muir ..... 61

## H

Hawkins, W. T ..... 53
Hercules Float Works ..... 58
Hill Electric Switch Co ..... 53
Hoffman, G. W ..... 52
Hygienic Laboratories ..... 60

## I

Ideal Steam Separator & Supply Co ..... 6

## J

Jenckes Machine Co ..... 3
Johnson, F. M. G ..... 58
Jones & Moore Electric Co ..... 52
Jones Underfeed Stoker Co ..... 63

## K

Kerr Engine Co ..... 8
Kilmer, Pullen & Burnham ..... inside back cover

## L

Leonard, E., & Sons ..... 3
Liberty Mfg. Co ..... 49
Lunkenheimer Co ..... 8

## Mc

McArthur, J. D ..... 13
McGhie, W. C ..... 62
McLaren, D. K., Ltd ..... 11
McLeod & Henry Co ..... 64
McRae, J. B ..... 58

## M

Merrill, Edward B ..... 58
Michigan Lubricator Co ..... 51
Mitchell, C. H. & P. H ..... 58
Moore & Scollan ..... 58
Morehead Mfg. Co ..... 9
Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

## P

Packard Electric Co., Ltd ..... 59
Peiler & MacKenzie ..... 8
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 54
Pierce, Wm. B ..... 7
Plomo Specialty Mfg. Co ..... 62
Polson Iron Works ..... 2

## R

Rhodes Improved Metallic Packing Co ..... 9
Robb Engineering Co ..... 12
Robertson, J. M ..... 58
Russel & Gifford ..... 7

## S

Sadler & Haworth ..... 10
Sammett, M. A ..... 58
Shanly, J. M ..... 58
Sight Feed Oil Pump Co ..... 9
Skaleoff Co ..... 60
Smith, Kerry & Chace ..... 58
Snowdon, S. S ..... 61
Standard Engineering Co ..... 9

## T

Technical Books ..... 14
Turbo-Blower Co ..... 53

## W

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 63
Wilson, J. C., & Co ..... 58

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 11 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five ye rs.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1¼" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### Machinery Wanted

Boiler wanted, 40 h.p. horizontal tube. Must be in first class condition. State full particulars. Imperial Extract Co., Toronto. (6)

D. Maxwell & Sons, St. Mary's, Ont., want Second-hand Air Compressor in good condition. Belt driven, with capacity of about 100 cubic feet free air per minute.

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

One Second-hand Slide Valve Engine, 14 x 18.
One Second-hand Slide Valve Engine, 10 x 15.
One Second-hand Slide Valve Engine, 12 x 16.
New Return Tubular Boilers, 60 x 14 and 72 x 18.
Second-hand Return Tubular Boilers, 36 x 10, 44 x 12, 48 x 12.
OWEN SOUND IRON WORKS, Limited, Owen Sound.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

Transmission Machinery—Write us for prices on shafting, hangers, pulleys, etc.; will promptly figure on any specifications submitted.

Flour Mill Machinery.

The Brown Automatic Engine.

Boilers.

The STRATFORD MILL BUILDING CO., Ltd., Stratford, Ont.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

A 3 h.p. 2 phase 110 volt 66 cycle Canadian General Electric Motor, in good shape—a bargain. Also a 5 h.p. and a 15 h.p. Motor, and transformers in stock.

NORTHERN ELECTRIC SUPPLY CO.,
(5) Orillia, Ont.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBONTYPE PORTABLE BOILERS—7' each, 60 h.p.

HEINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

BOILERS—Any size or style required; smokestacks built to order; also steel tanks, steel riveted pipe for flues, etc.; write for prices. Marsh & Henthorn, Belleville, Ont.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12 x 12 M'Ewen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumps, second hand. Waterous Engine Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

### For Sale

One Westinghouse Generator, 54 k.w. Direct current, 125 volts, speed 850, complete with switchboard, instruments, etc. Best of order. Will sell reasonable. Mr. Taber, 444 Bathurst St., Toronto. (8)

### For Sale

48-inch "Stillwell-Bierce" Turbine, gears and shafting. A. F. Fifield, St. Catharines, Ont.

### For Sale

Two Fitzgibbon Boilers for sale at a bargain. Are now carrying 70 lb. pressure. Would make splendid heating boilers. G. C. Mooring, 16 Pearl Street, Toronto. (9)

### For Sale

ONE 5 h.p. Cook vertical gasoline engine, double ignition, complete with tank, skids, and all accessories. A new engine at a bargain for quick sale. Kellogg & Co., 196 King St. West, Toronto.

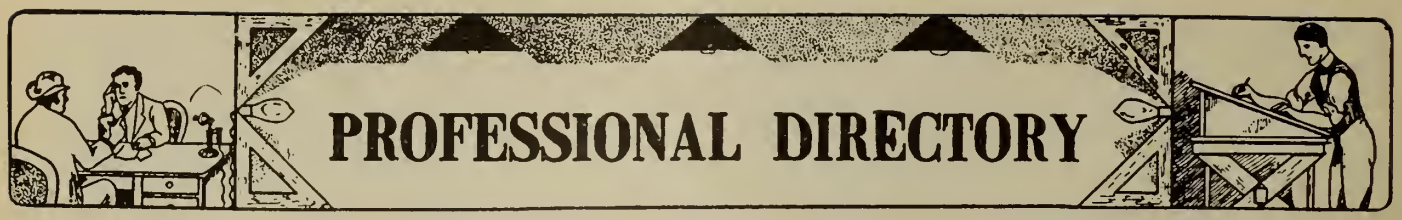

## SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

THE POWER HOUSE
10 Front St. East, TORONTO



# PROFESSIONAL DIRECTORY


**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST, WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg, Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737 East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**SMITH, KERRY & CHACE**
ENGINEERS
Hydraulic, Steam, Electric, Railway, Municipal, Industrial
W.U. Code used. Cable Address "Smithco."
TORONTO — WINNIPEG — CALGARY
Cecil B. Smith — J. G. G. Kerry — W. G. Chace

HARRY A. MOORE — JOHN J. SCOLLAN
**MOORE & SCOLLAN**
ELECTRICAL AND MECHANICAL ENGINEERS
STEAM, ELECTRIC AND HYDRAULIC POWER
CONSULTATION, REPORTS,
ESTIMATES, PLANS, CONSTRUCTION, TESTING, ETC.
OFFICES: GUARANTEE BLDG., 43 KING ST. W.
TELEPHONE MAIN 445 — TORONTO, CAN.

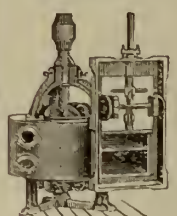
**F. M. G. JOHNSON,**
Ph.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 27: 6

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**EXPERTS**
ON
SMOKE PREVENTION
AND
BOILER ROOM EQUIPMENT
Canadian Representatives:
THE TRIUMPH STOKER, Leeds, Eng.
CONSULTING ENGINEERS
Steam Hydraulic Mechanical
BAIN & MITCHELL,
Y.M.C.A. BUILDING, MONTREAL.

**HERCULES Seamless Copper FLOATS**
**Are Absolutely Reliable**

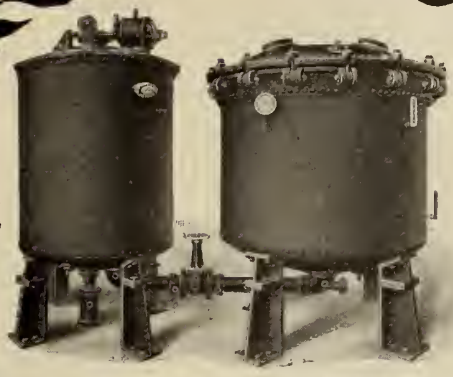
We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request,
**Hercules Float Works**
P.O. Box 393. — Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**

Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest efficiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty.

THE
**EMIL PASSBURG SYSTEM**
**VACUUM DRYING AND IMPREGNATING**

Dries and Impregnates electric cables, dynamo and motor armatures, field and magnet coils, etc. Impregnating compound enters the vacuum chamber without breaking the vacuum, thus eliminating the possibility of the dried coils reabsorbing moisture. The most economical and satisfactory Drying and Impregnating process known to science.

All sizes and types. Write us for complete catalog.



**J. P. Devine Company**
BUFFALO N. Y.

**LUFKIN MACHINE DIVIDED RULES**
**ARE STANDARDS OF ACCURACY AND MATERIAL**

Our catalog tells about their many superior features.
It's sent free on request.

THE LUFKIN RULE CO. OF CANADA, LTD.
WINDSOR, ONT.

# THE WATER TEST

*Packard*

## Type "D" Motor

Reproduction from an actual photograph, showing the "Water Test" as applied to a Packard Type "D" Motor.

shown in the picture, proves one of the many points about the PACKARD Type "D" Motors, that combines to make them peculiarly adaptable for severe operating conditions.

The test consisted of a submersion of the motor in a tank. Connection being made to the circuit, the motor was allowed to run—completely under water—for several hours at a time—and, after repeated tests, the insulation was found to be in no-wise affected.

Could you ask better proof of the **ruggedness of design** and **careful construction** of the motor; or of the success of our Vacuum process of insulation?

## The Packard Electric Co., Limited

Head Office and Works
St. Catharines, Ont.

Branch Offices
Montreal and Winnipeg

# Are YOU weary of the trouble caused by scale in your Boilers?

**Was last month's coal bill more than expected?**

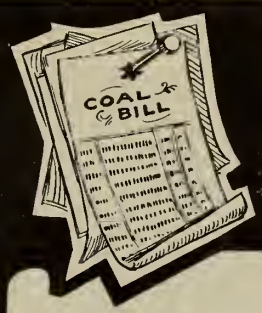
If so we want to get in touch with you because it will be to our mutual advantage. If you are paying out good money for devices for cleaning tubes, overtime to do this work, expensive oil filters, it will pay you to consider the fair and square offer of ours, to supply you with the means for eliminating these troubles.

There are no strings to this offer: We merely want the chance to show you how much better it is to have expert chemists analyse your own particular feed water and treat it accordingly, than it is to buy "Quack Medicine" in the form of boiler dope that is sold for any old feed water any old place

## Read This Fair and Square Offer and Guarantee

Send a gallon of your feed water to us AT OUR EXPENSE. We will analyse it in our up-to-date laboratory and prepare a barrel of "SKALEOFF" especially to suit your individual requirements. If this fails to give you complete satisfaction and clean boilers (you are the judge) your money will be refunded without a murmur. We fully guarantee "SKALEOFF" to absolutely prevent scale, oil, corroding, pitting, foaming, etc.

***THE "SKALEOFF" CO. - 97 SHANNON STREET, MONTREAL***




# BOILER SCALE IS A LUXURY!

A stock boiler compound isn't much use—boiler feed water differs too much in chemical composition. The only way to keep scale out of your boiler is to feed a compound specially made to suit the conditions of your feed water. That's why we don't keep stock compounds. Every barrel of Red Star Compound is made to cope with special conditions—and it meets them. We analyse your feed water free of charge, and then if you desire it, we will make you up some Red Star Compound which we absolutely guarantee will clean out any old scale and prevent the formation of any new scale in your boiler. Your money back—right away—if Red Star fails. Moreover, whoever uses Red Star Compound is loaned one of our Perfection Automatic, Back Pressure, Boiler Compound Feeders absolutely free.

***Send us a Gallon of your Boiler Feed Water for a FREE ANALYSIS***

## HYGIENIC LABORATORIES, LIMITED

11 COLBORNE STREET - - - TORONTO

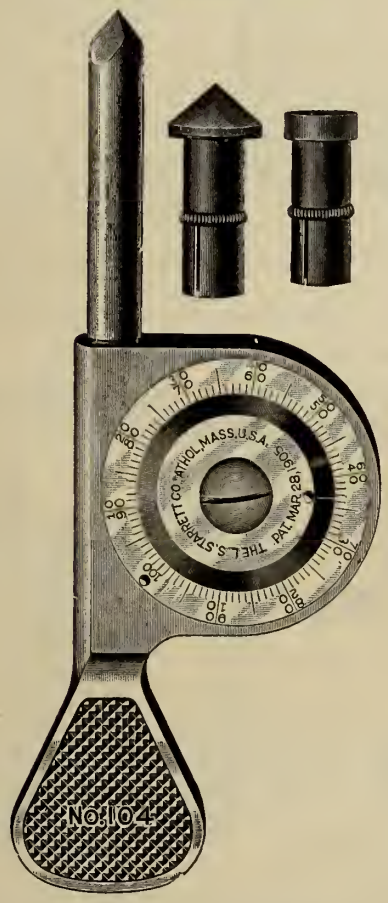
# RED STAR COMPOUND KILLS SCALE!

THE POWER HOUSE

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

**PUBLISHED MONTHLY AT $1.00 PER YEAR.**
**Start in TO-DAY to earn one of these handy Tools.**

## THE POWER HOUSE
**10 Front Street East TORONTO**



# Potato Scale Powder Boiler Cleanser

***The Fuel Saver***

NO EFFECT ON THE BOILER PIPES SHELL OR CONNECTIONS

KEEPS YOUR BOILERS FROM FOAMING

We can furnish you with hundreds of testimonials from some of the best plants in the world.

**Guaranteed to give satisfaction.**

Sole Agent for America:

Mail us a sample of your water and we will prove to you that we keep your boiler clean without doing it any damage, besides save you a lot of money in fuel.

## C. C. SNOWDON
**Wholesale Oil Merchant** CALGARY, Alta.

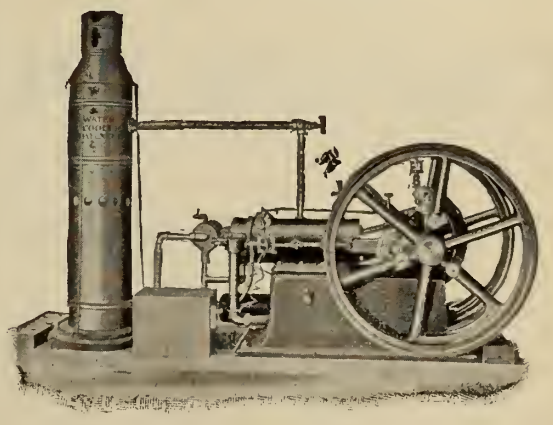
P.O. Box 1384 Phone 417
Address all Correspondence to Calgary

Branch Storage at New York
Branch Storage at Montreal



# GAS and GASOLINE ENGINES

## 1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

## Goold, Shapley & Muir Co.
Limited

**BRANTFORD · CANADA**

## PLOMO BELT DRESSING

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical—a spoonful will dress an 8-inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places. Permits belts to be run slack without slipping—slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

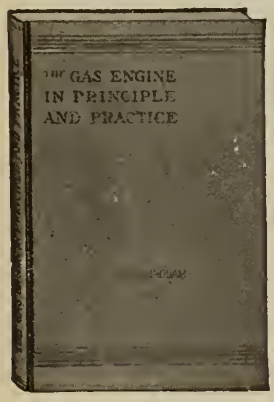
*Write for booklet and free sample package.*

**THE PLOMO SPECIALTY MFG. CO.**
**CLEVELAND, OHIO.**

## Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over in the Province of Ontario must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act.

W. C. McGHIE,
Chairman of Board
Parliament Buildings, Toronto.




## The Gas Engine in Principle and Practice

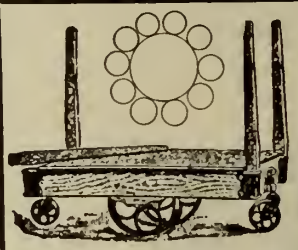
*By A. H. Goldingham*

***Price $1.50, Postpaid***
***195 Pages, 107 Illustrations***

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Varorizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

***Technical Book Department***

**The MacLean Publishing Co., Ltd.,** 10 Front St. East, Toronto



Roller Bearing Factory Truck

Roller Bearing Factory Trucks
The only ones made in Canada

Dry Kilns Installed
Roller Bearing Dry Kiln Trucks
Roller Bearing Transfer Trucks
Roller Bearing Lumber Trucks

MUNICIPAL STEEL BRIDGES Specifications Solicited . .

We make any kind of truck to specifications. Heavy duty truck a specialty. Write for prices to

Corbet Foundry & Machine Co., Owen Sound

# The Dymond Gas & Engine Co.
LIMITED

131 Queen St. East, TORONTO

MAKERS OF

# GAS PRODUCERS PRESSURE AND SUCTION

FOR ANTHRACITE COAL

Pressure Bituminous Plants for Large Instalations

# HIGHEST THERMAL EFFICIENCY

AGENTS FOR

The largest makers of gas engines in the world---Vertical and Horizontal, all sizes and types

WILLANS & ROBINSON STEAM TURBINES

All classes of Pumps and Pumping Machinery

If your present power is not satisfactory, advise us and we will help you out and guarantee results

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

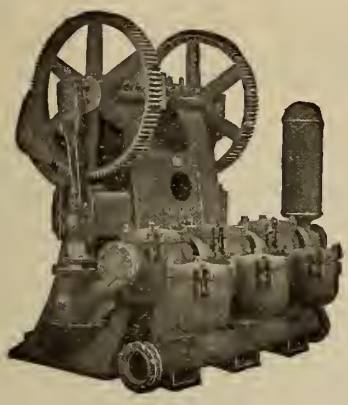
## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA





## On Account

of their

Extremely Low Cost of

Operation and the Small

Amount of Attention

Required

## Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**
Coristine Bldg., Montreal
Phone Main 1054

*Works - - - - - - Seneca Falls, N.Y.*



# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization ?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

NEW YORK CITY BRANCH,
1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS
TROY, N.Y.

# Prevention is Better than Cure

To Prevent your Bearings Running Hot

Use Harris Heavy Pressure Bearing Metal

Manufactured and Guaranteed by

## The Canada Metal Co., Ltd., Toronto

# Specialists in the Cure of Electrical Diseases

**The Electrical Maintenance & Repairs Co.**

162 Adelaide St. West, Toronto

Phone Main 3419



# The General Electric Co. of Sweden

400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.

¶ Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

SOLE CANADIAN AGENTS:

**Kilmer, Pullen & Burnham,** 505 McKinnon Building, TORONTO

# "Morrison Steam Specialties"

**Assurance of Strength and Durability** in the purchase of your steam goods is a matter of first consideration.

We concentrate our best efforts on all specialties bearing the **J.M.T.** trade-mark and standard goods stamped with our name, surrounding their use with a confidence for **safety** and **satisfaction.**

You can depend upon the quality of material and workmanship in the construction of

**J.M.T. Valves**
**"Morrison" Steam Cocks**
**J.M.T. Injectors**
**"Morrison" Steam Gauges**
**and other kindred lines.**

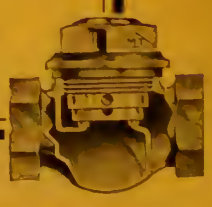
Use the best for your steam plant. The cost is little more, if any, than the lower grade, and you get the benefit of long service and added efficiency.

## The Jas. Morrison Brass Mfg. Co., Limited

**93-97 Adelaide St. West, - - TORONTO**

Manufacturers of
High-Grade Steam
Specialties

Dealers in
Iron and Brass Pipe and Fittings,
Pipe Fitters' Tools, etc.



CIRCULATES IN EVERY PROVINCE OF CANADA

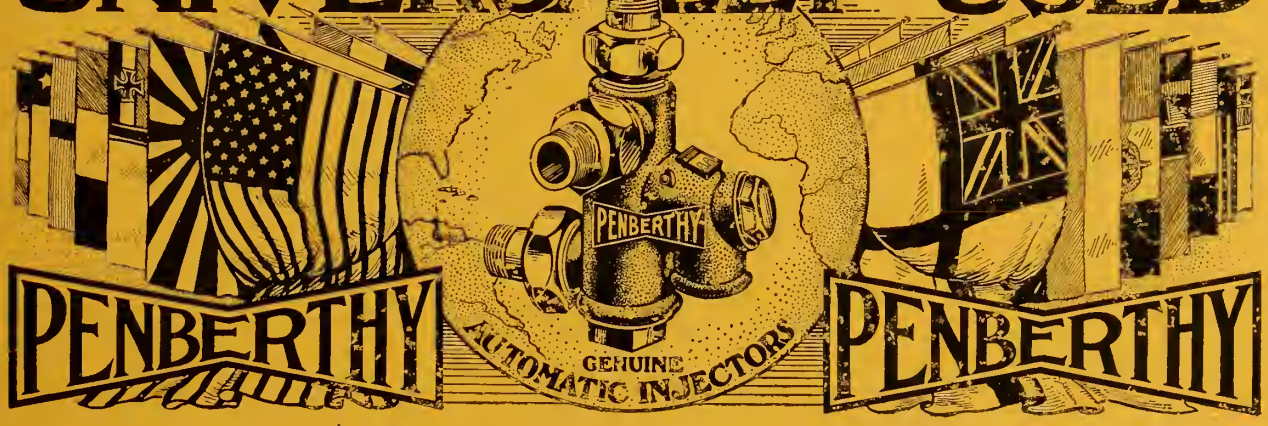
# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power. Published by MacLean Publishing Co., Ltd., Toronto, Montreal, Winnipeg, London, Eng.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C.

Vol. II. Publication Office, Toronto – September, 1909 No. 9

UNIVERSALLY USED




*"The Sun Never Sets on the Genuine Penberthy Injector"*

**EXPERIENCE**
Twenty-five Years

**MATERIAL**
The best grade of metal

**WORKMANSHIP**
Skilled Mechanics who know how

is what we give you when we sell you the Genuine Penberthy Injector

**RELIABILITY**
They always work

**ECONOMY**
Saves time, trouble and worry

**SATISFACTION**
Getting your money's worth

is what you get when you buy the Genuine Penberthy Injector

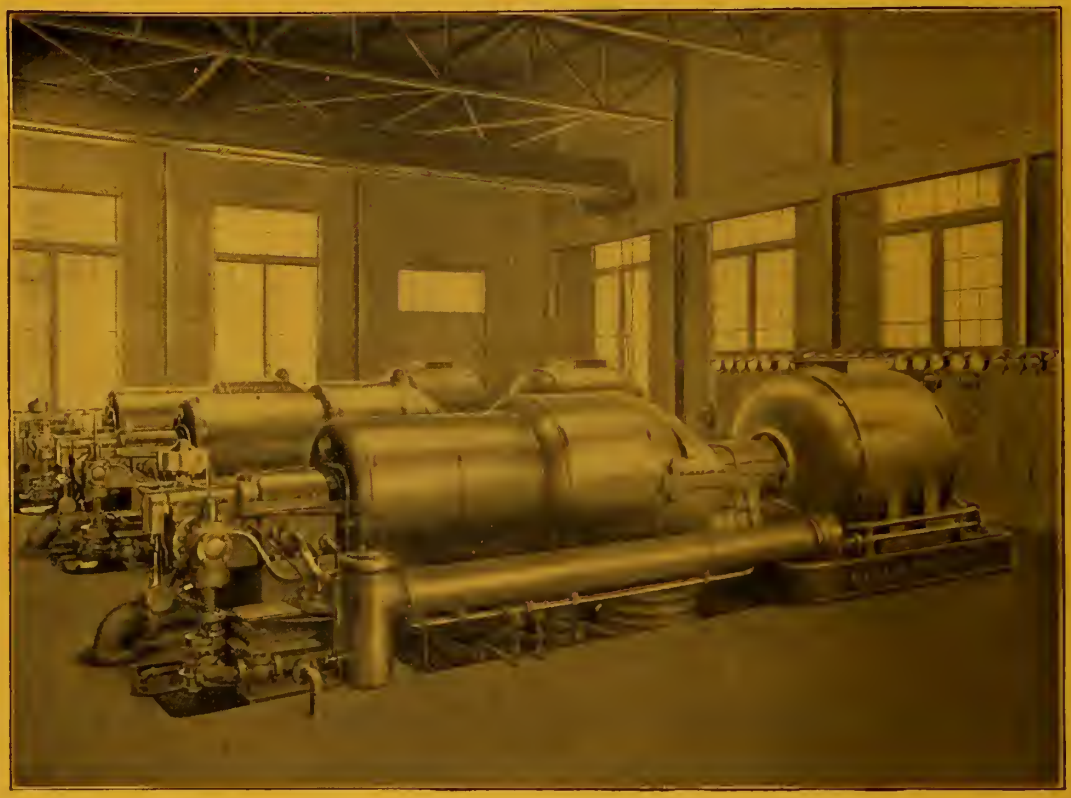
**The Best by Every Test**

MANUFACTURED BY

**PENBERTHY INJECTOR CO., Limited : WINDSOR, ONT.**

# Steam Turbines and Electric Generators

## IN CAPACITIES FROM 300 K.W. TO 20,000 K.W.



Three 1,000 k.w. Steam Turbines and Generators in the Power House of the Western Canada Cement and Coal Co., Limited, Exshaw, Alta.

### Standard Condensing Turbines

Standard Condensing Steam Turbines, as shown in the above illustration, which receive steam at high boiler pressure and exhaust into vacuum, for ordinary power generation.

### Non-Condensing and Partially Condensing Turbines

Non-Condensing Steam Turbines which receive steam at high boiler pressure and exhaust against atmospheric or higher back pressure, for use where exhaust steam is required for heating or similar purposes.

### Low Pressure Turbines

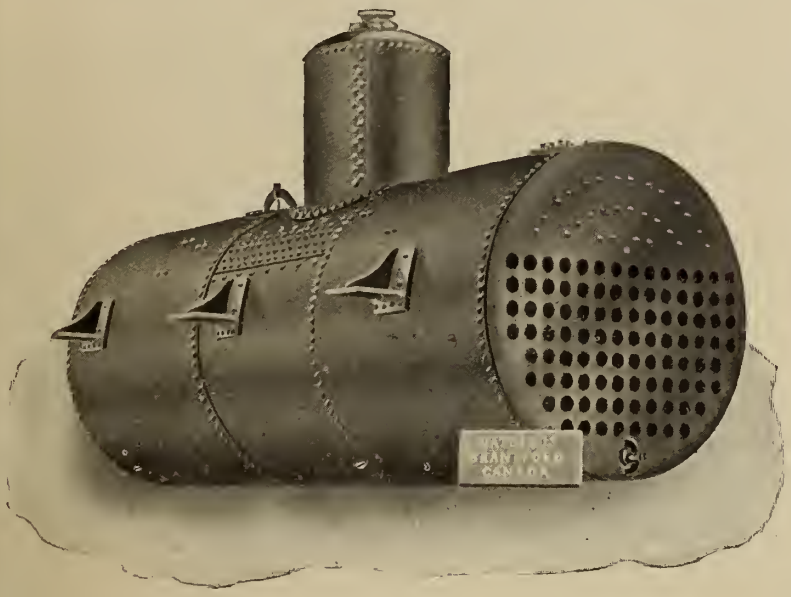
Low Pressure Steam Turbines which receive the exhaust steam from reciprocating or intermittently operating engines, at about atmospheric pressure, and exhaust into vacuum. These turbines afford the cheapest and simplest means for increasing both the capacity and the efficiency of either condensing or non-condensing engine plants, by converting residual steam energy (heretofore wasted) into useful power.

## ALLIS - CHALMERS - BULLOCK LIMITED

## Works : Montreal

***Sales Offices: MONTREAL, TORONTO, WINNIPEG, VANCOUVER***
***COBALT, CALGARY***

# POWER PLANTS



WE MANUFACTURE

## BOILERS

Return Tubular, Locomotive, Scotch, Upright and Marine.

## ENGINES

McEwen Automatic—Simple or Compound.

## ALL STEAM PLANT ACCESSORIES

Write for Prices and Bulletins

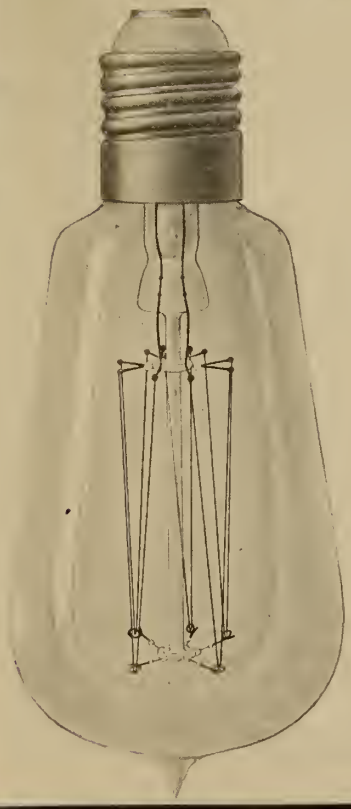
**THE WATEROUS ENGINE WORKS CO., Limited**

BRANTFORD - CANADA

Western Branch : Winnipeg, Man.

B.C. Agent: H. B. Gilmour, Vancouver

# THE "JUST" TUNGSTEN LAMP



"The Lamp you will eventually buy"

Consumes less than one watt per c.p.

***96-25-40 C.P. 100-120 Volts.***

***1000 Hours.***

Better send in for our prices.

While doing so remember that we can supply you with anything in the electrical line---and our prices are right.

## Sterling Electric Supply Co.

*Limited*

"Something electrical for everybody"

***369 Yonge Street - Toronto, Ont.***

In the consideration of a

# Modern Steam Plant

there are four principal offices of a good boiler:

1. Absorption and transmission of heat, determining the capacity and making for economy.
2. Safety at high pressure.
3. Dryness by the separation of steam from water.
4. Precipitation and discharge of scale and mud.

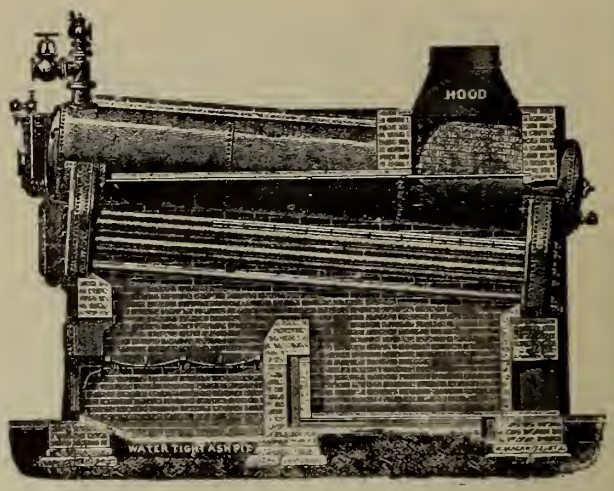



Fig. 1.—Heine Boiler and Setting

In each of the above features the palm is held by

# Heine Safety Boilers

which hold the record for honest, consistent and economical work in a large number of the world's most modern steam plants.

The **HEINE BOILER** is not only so constructed that it will best absorb and transmit the heat, but it is so arranged that the heat will best reach it. Safety at high pressure is guaranteed by the most careful selection and testing of materials, all final tests being carried out by the Bureau of Inspection and Tests. Dryness is obtained by an active agent, present at all times in the boiler, which becomes more vigorous the more the boiler is pushed. And lastly precipitation and discharge of scale and mud is effectively assured by the use of the **HEINE MUD DRUM.**

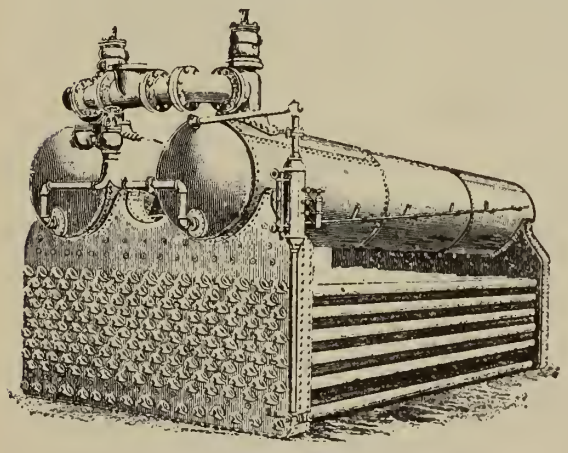


Fig. 2.—The Heine Boiler Without Brick Setting

Actual or prospective Boiler Purchasers are invited to make the fullest enquiries. Remember, every **HEINE BOILER** is tested ***as a whole*** before shipment.

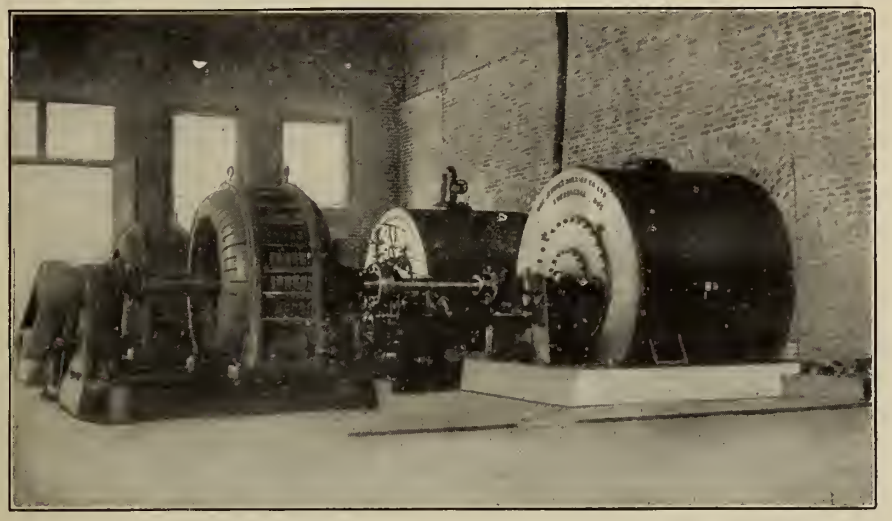
---

OUR LITERATURE WILL INTEREST YOU

***Write for it to-day.***

# Polson Iron Works, Limited

## Toronto, - Canada



2-Pairs 21" Cylinder Gate Improved Turbines direct connected to Electric Generators

# Turbine Water Wheels

¶ Our Improved Turbine is perfectly adapted for Hydro-Electric installations.

¶ We build it in various styles of setting in all sizes and for heads up to 150 feet.

¶ We also design special settings to suit special conditions.

¶ Specifications from consulting engineers are invited and catalogue will be sent to any address on request.

## The Jenckes Machine Co., Limited

**General Offices: Sherbrooke, Que.**

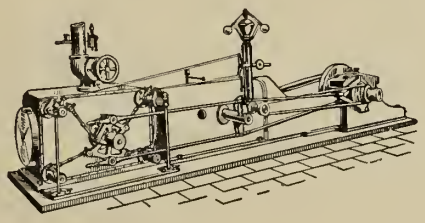
**Works: Sherbrooke, Quebec. - St. Catharines, Ontario**

**Sales Offices: Sherbrooke - St. Catharines - Cobalt - Rossland - Vancouver - Montrea**

*Please Address Enquiries to Nearest Sales Office.*

## ENGINES—

**Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper**



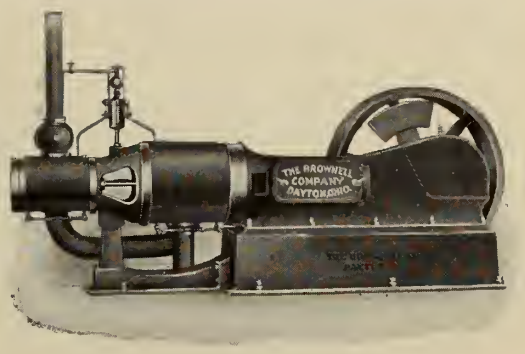
## BOILERS—

**Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.**

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

**LONDON, - ONT.**




## The Brownell Company

**Dayton, - Ohio**

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# NEW MODEL
# DIAMOND SHAKING AND DUMPING
# ——GRATE BAR——

*By using Diamond Grates you increase your power from 5 to 20%*

*The Diamond Grate is applicable to any type of boiler and to units of any size.*

CANADIAN PATENT 118,778

## THE DIAMOND GRATE

## Has no Equal as to Simplicity and Durability

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal.

TORONTO, Aug. 5th, 1909.

THE DIAMOND GRATE BAR CO.,
119 St. James Chambers, Toronto.

Gentlemen:—The Grate Bars are all you claim for them. The two (2) sets you put in for the Toronto General Hospital are giving perfect satisfaction. They are the most economical bar I have had anything to do with. They are simply perfect. We have had no trouble in burning half and half soft and hard coal screenings, which we could not do before we adopted The Diamond Grate Bar. I can highly recommend the Bar.

With best wishes for your success, I remain, yours truly,

A. E. BENNETT,
Engineer Toronto General Hospital,
Toronto, Ont.

**We make a Specially Heavy Bar for Steamboat and Malleable Annealing Ovens.**

***Boiler Setting and Repairs a Specialty***

***Boiler Tubes, Either Welded or New, at Lowest Price***

*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

A POST CARD OR PERSONAL INQUIRY WILL BRING A PROMPT REPLY

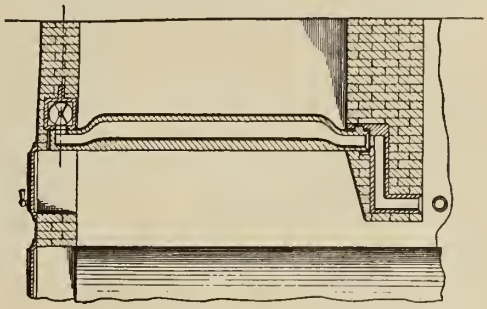
# The DIAMOND GRATE BAR Company

Head Office and Factory, Berlin, Ont.

Branch Office, 119 St. James' Chambers, Toronto. Tel. M 1342

# 10% to 30% SAVING

Proven by Evaporation Tests



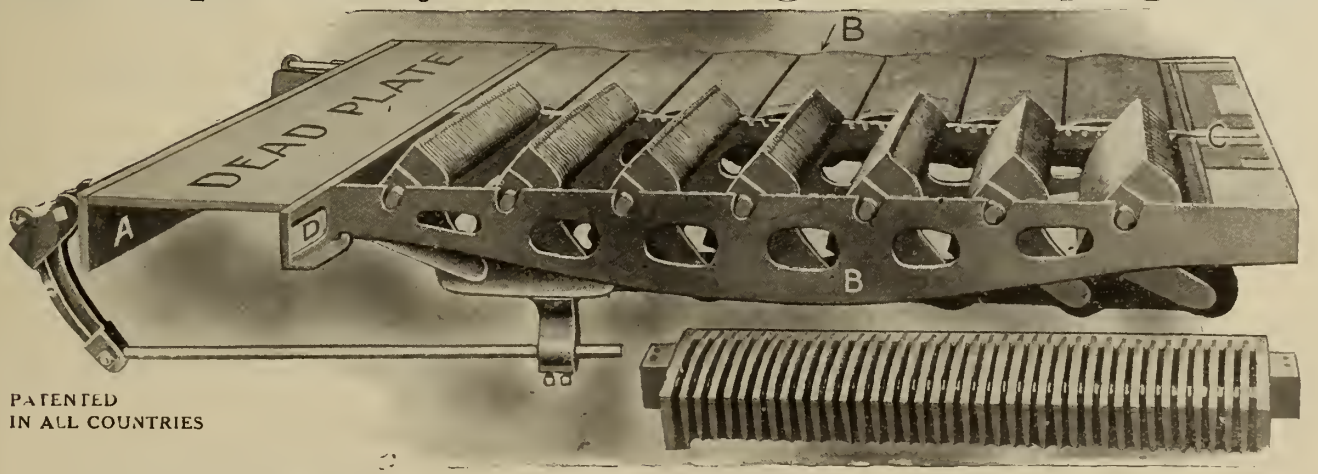
# FLEMING GRATE BARS

Write for Booklet with full Information

## BUTTERWORTH FOUNDRY, LIMITED

BROAD STREET : OTTAWA, ONTARIO

## The Improved Cyclone Shaking and Dumping Grate




PATENTED
IN ALL COUNTRIES

**EFFICIENCY** with **ECONOMY**

The three improvements which have recently been added to this already deservedly popular grate, add very materially to its qualities as a fuel saver and also to the length of life of the bar. Irrespective of the kind of coal used, we claim we can effect a saving in your fuel bill.

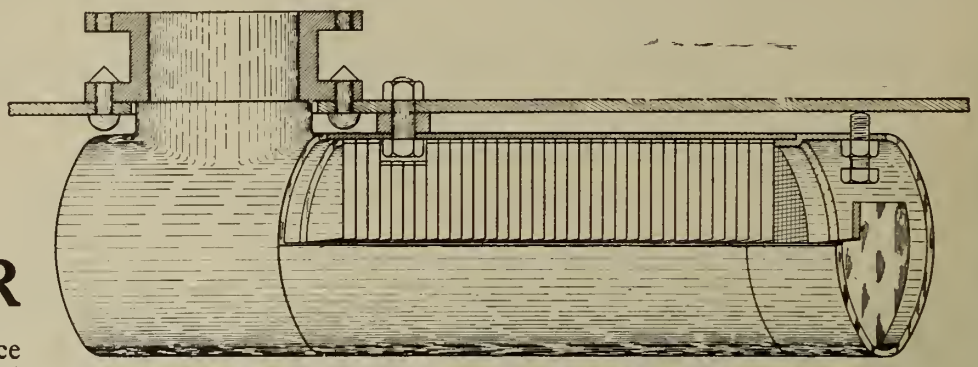
WRITE FOR CIRCULAR AND FULL PARTICULARS

## Canadian Steam Boiler Equipment Company, Limited

186 Queen Street East - - - - - - Phone Main 1422 - - - - - - - - - TORONTO

**True Economy** in the running of your plant lies in using steam as dry as possible. Wet steam is dangerous and expensive, and can only be got rid of by the use of some kind of separator. Why not instal the most effective kind, the

# IDEAL INTERNAL STEAM SEPARATOR



This modern boiler appliance is placed inside the boiler, and when the cost of installation is met, it calls for no further expense and no attention whatsoever. It is an absolute safeguard against accident to engine by water shock, and is a great fuel saver. It also saves oil, packing and time, lessening at the same time the wear and tear of engines, pumps and compressor plant.

WRITE FOR OUR FREE DESCRIPTIVE BOOKLET

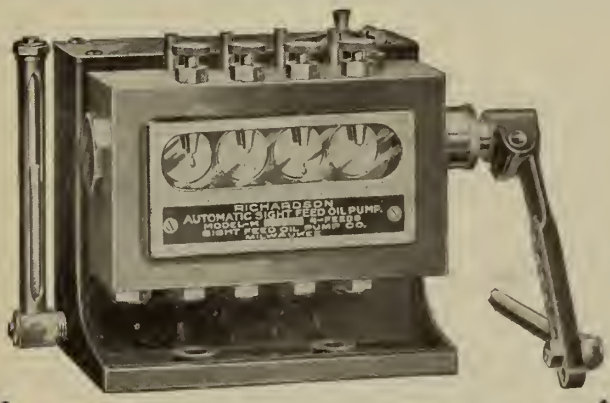
## Ideal Steam Separator and Supply Co.

75 Adelaide Street East, Toronto, Ontario

We also manufacture Potter Separators, Whaley Automatic Smoke Preventers, and Leonhardt Gauge Glass Protectors.

Selling Agents for Wm. W. Nugent & Co., Chicago, Lubricating Devices; Harris Smokeless Furnace Co., Nashville, Tenn.; Watson & McDaniel Co., Philadelphia, Steam Traps and other steam specialties.

WRITE FOR CATALOGUES




## Automatic Lubrication

### The Richardson Automatic Pump, Model M

Automatic lubrication is a good feature—**uniform** lubrication is **better,** because it's **economical.**

The delivery of large quantities of oil at long intervals is a wrong principle—entirely. No man can eat enough at one meal to last him three days, and no engine can consume sufficient oil at one time to last twenty revolutions. Enough oil can be **delivered** but only **half is** used. The other half runs through the engine and becomes waste.

The **one correct way** is the **Model M** way, a delivery of sufficient oil to the steam at **every** revolution of the engine. Thus, you get a dollar's worth of service from every dollar's worth of oil.

Send for Bulletin No. 209-L.

**SIGHT FEED OIL PUMP CO., Milwaukee, Wis.**

THE WATKINS SERVICE CHICAGO

# RIGHT NOW

While overhauling your steam plant put in the

## Dart Unions and Flanges

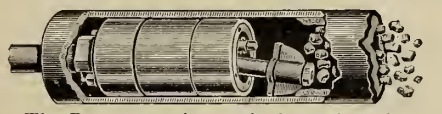
It's economy
They never need attention
and never leak

GUARANTEED BY

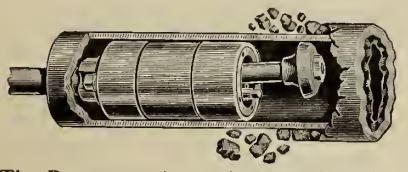
## Dart Union Company

LIMITED

TORONTO, MANUFACTURERS



The Dean removing scale from the tube of a Water Tube Boiler.



The Dean removing scale from the tube of a Return Tubular Boiler.

## Are Your Boilers Operated Economically?

Wouldn't you like to cut down their fuel consumption—increase their steaming capacity—eliminate loosened and burned out tubes?

## The Dean Boiler Tube Cleaner

is what you need. You will have no idea of what scale is costing you until you see how much you can save after tke Dean has thoroughly removed the scale from your boiler tubes.

"Scale Removal Made Easy"—yours for the asking.

**THE WM. B. PIERCE CO., - 330 Washington Street,**
BUFFALO, N.Y.

## The Nichols Chemical Company, Limited

HEAD OFFICE: 222 ST. JAMES ST., MONTREAL

# ACIDS AND CHEMICALS

WORKS:
Capelton, Que.
Sulphide, Ont.
Barnet, B.C.

**TRI-SODIUM PHOSPHATE**
Purest Commercial, 100%, for prevention of scale in boilers.

WAREHOUSES:
Toronto, Ont.
Montreal, Que.

## Did you Ever Stop to figure out what Boiler Scale 1/16" thick means to your Coal Bill?

¶ Every time there is the tiniest amount of scale formed in your boilers, more coal must be used to heat the scale before the water can be affected.

¶ Not only that, but there is the expense of cleaners, cleaning and time lost in the operation.

¶ Isn't it reasonable, then, to say that no scale means less coal for same amount of steam evaporated and no expense for tube cleaners etc?

¶ Isn't it also reasonable to state that "SKALEOFF" which is a pure, effective, vegetable compound and is prepared by expert chemists in a modern laboratory to suit each and every individual feed water requirement; we say, isn't it reasonable to state that this is better than the Quack Medicine put up in bulk and shipped (the same stuff) to any old boiler, any old place, for use with any old feed water?

## *NOW NOTE THIS "Money Back" Proposition.*

¶ We ask you to send (AT OUR EXPENSE) a gallon of the feed water used in your plant and the approximate amount of water used per day. We will have it carefully analysed in our laboratory and will prepare a barrel of "SKALEOFF" especially to suit your own particular requirements.

¶ This we will ship to you, to test and judge for yourself. If it is not satisfactory, you will not be charged a cent. If it is—talk business. Send sample to-day and let us get started on the analysis.

***THE "SKALEOFF" CO. - 97 SHANNON STREET, MONTREAL***

# Our Business Is To cut out trouble
# To reduce waste
# To give increased efficiency

# Our Business Is growing because we deliver the goods that do the work

**Mason** Reducing Valves, Pump Pressure Regulators, Damper Regulators, Pump Speed Governors, Balanced Valves.

**Reilly** Multicoil Feed Water Heaters Surface Condensers and Evaporators. The most compact and highly efficient. The lowest is first cost.

(Genuine) **Ashton** Pop Valves, Pressure and Vacuum Gauges (both indicating and recording), Relief Valves, Alarm Gauges.

**Bundy** Steam Traps, Steam and Oil Separators. The best steam trap made and the most efficient for every service.

These lines appeal to the best judgment of every engineer who takes the trouble to investigate their merits. We represent the manufacturers and are responsible for the reputation of the goods we sell. Our specialty is the economical solution of all problems relating to pressure regulation, and the handling of hot water and returning water direct to the boilers irrespective of temperature or pressure. We have expert engineering service at our disposal.

***ENGINEERS CONFER A FAVOR ON US BY ASKING FOR CATALOGUES AND INFORMATION***

## Peiler & MacKenzie - - - 52 St. James St., Montreal

## *KERR GATE VALVES*

*are to be found in all well equipped steam plants in Canada.*

*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

***The Kerr Engine Co., Limited***

***Valve Manufacturers***

***Walkerville, - Ontario***

The only way to ascertain the value of an article is to give it a trial. Those who have tried a

## LUNKENHEIMER AUTOMATIC INJECTOR

claim that it lifts water higher, forces against a greater over-pressure, takes hotter water, gives better satisfaction and outlasts any other make on the market.

Write for Catalogue

Your Local Dealer Should Have Them; If Not, Write Us.

THE LUNKENHEIMER COMPANY

LARGEST MANUFACTURERS OF HIGH-GRADE ENGINEERING SPECIALTIES IN THE WORLD

General Offices and Works, CINCINNATI, Ohio, U.S.A.

BRANCHES { New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E., 35 Great Dover St.

43

# The Up-to-Date Way

TO MAKE STEAM

IS BY FORCED DRAFT
AND THE CHEAPEST FUEL
YOU CAN BUY

# "Wing System"

IS THE CHEAPEST TO INSTAL
ALSO THE CHEAPEST TO OPERATE

MADE BY

## Russel & Gifford

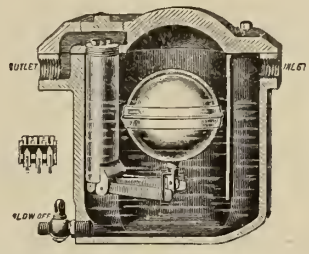
505 Power Bldg. MONTREAL

404 McKinnon Bldg. TORONTO

We are also Agents for

## BUNDY STEAM TRAPS

WRITE FOR CATALOGS




# WRIGHT EMERGENCY STEAM TRAPS

for High Pressure
continual flow.

*Three Valves, Great Capacity for pressure up to 250-lbs.*

They are standard the world over. Send for Pamphlet W. Carried in stock.

## Darling Brothers, Limited

15 Ottawa Street,

Toronto **Montreal** Winnipeg

# MOREHEAD

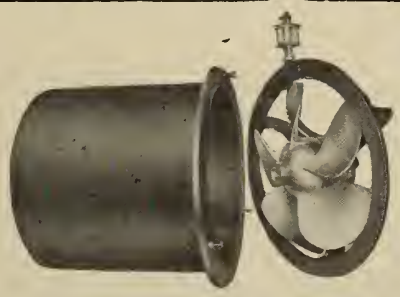
## Return and Non-Return Steam Traps and Boiler Feed

FOR YOUR STEAM LINES

AN IDEAL investment for power plants. Will absolutely insure more economical operation of heating systems. This space will not permit the listing of benefits and economies that go with a Morehead Trap installation. Send for catalogue and get the facts.

Canadian Representatives:

A. R. WILLIAMS MACHINERY CO., Toronto, Ont.
W. H. MARKLE, Montreal, Que.
PARK BROS., Chatham, Ont.



## More Power
For the
## Same Money
OR
## Same Power
For
## Less Money

We want to hear from the Engineer who says:

"MY BOILERS DON'T NEED MECHANICAL DRAFT. THE NATURAL DRAFT IS SO STRONG IT WILL DRAW YOUR HAT UP THE CHIMNEY."

He forgets that the same force that carries his hat away will also draw up all the hot gases by the shortest cut.

THE TURBO-BLOWER OPERATES WITH THE DAMPER PARTLY CLOSED, AND DOES NOT PERMIT THE GASES TO ESCAPE UP THE CHIMNEY UNTIL THEY HAVE BEEN FORCED AGAINST EVERY PART OF THE HEATING SURFACE OF THE BOILER.

***HENCE THE ECONOMY.***

Send for our Pamphlet.

TURBO-BLOWER CO., 30 Church Street, NEW YORK, N.Y.

Represented in Eastern Canada by W. H. Adams, 102 Nazareth St., Montreal.
Represented in Western Canada by Standard Engineering Co., Ltd.,
Head Office: 47 Wellington St. East, Toronto.

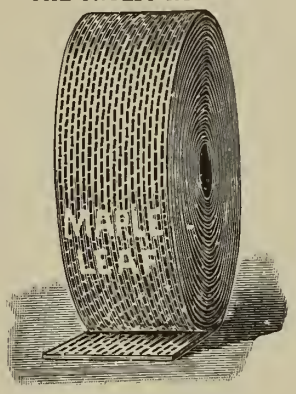
**DOMINION BELTING CO., Limited**
HAMILTON, CANADA

SOLE MANUFACTURERS OF THE CELEBRATED

**"MAPLE LEAF" BRAND**
**Stitched Cotton Duck Belting**
FOR TRANSMISSION OF POWER, CARRYING, ETC.

THE TRUEST RUNNING

THE STRONGEST



THE MOST ECONOMICAL BELT

MADE IN CANADA

As a Main Drive Belt "Maple Leaf" cannot be excelled. Write for prices.

"MAPLE LEAF" BELT DRESSING is the best on the market for all kinds of belts.

**PLOMO BELT DRESSING**

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical—a spoonful will dress an 8-inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places. Permits belts to be run slack without slipping—slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

*Write for booklet and 25-pound package on trial.*

**THE PLOMO SPECIALTY MFG. CO.**
**CLEVELAND, OHIO.**

**Switch Board Parts**

**Bulletin 3A—Just Out.**

SEND FOR COPY.

**The Hill Electric Switch & Mfg. Co., Ltd.**

1560 St. Lawrence Street - Montreal

# BELTING INSURANCE

IN WET PLACES MEANS

# "ACME-WATERPROOF"

GOOD ALL THROUGH

SELECTED HIDES, SLOW-PROCESS TANNED, MADE BY EXPERTS

## ARE YOU INSURED?

# J. L. GOODHUE & CO.

DANVILLE, QUE.

Ask for our famous

# "Extra C"

and

# "Standard B"

They are the best belts on earth for general purposes.

## Old Father Time alone can outlast

# D. K. McLaren's

## Genuine British Oak Tanned

# Leather Belting

This belting is the product of long experience, careful selection of hides, and perfect facilities. We use only flawless centres of hides—all other parts being cut away before tanning. Our tanning process is the best in the world—the celebrated British Oak Tanning Process. Our belts are thoroughly reliable for the hardest service.

## D. K. McLAREN, LIMITED

**MONTREAL**
309-311 Craig Street West

**TORONTO**
200 King Street West

**QUEBEC**
21 St. Peter Street

**ST. JOHN, N. B.**
64 Prince William Street

**VANCOUVER, B. C.**
418 Abbott Street.

Full stock of our "Extra C," "Standard B" Leather Belting and "D.K." Balata at above addresses.

# EVERY ENGINEER SHOULD KNOW

ALL ABOUT

**WEAR WELL** LEATHER **WEAR WELL** PACKINGS

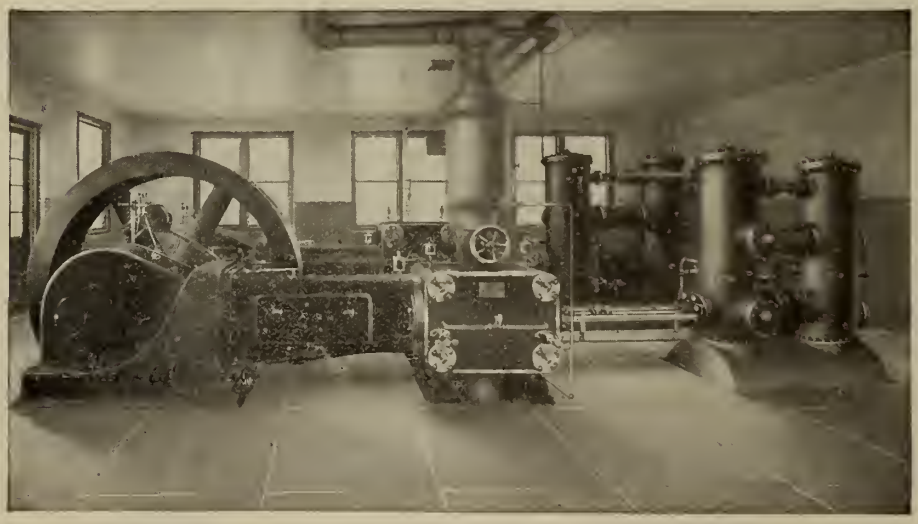
You have packing troubles and have never known where to procure Packings that would give satisfactory service. We manufacture "Wear Well Leather Packings" from the highest quality of leather, work to your specifications and guarantee every Packing to give satisfaction.

Made in all sizes and styles for use in Hydraulic and Compressed Air Machinery. Write for descriptive booklet.

## Detroit Leather Specialty Company, Inc.

DETROIT 87 Beecher Avenue MICHIGAN

# ROBB POWER PLANTS



## ENGINES

Corliss, Slide Valve, Horizontal, Vertical

## BOILERS

Return Tubular, Water Tube, Internally Fired, Portable

## Robb Engineering Co., Limited, Amherst, N.S.

DISTRICT OFFICES
709 Power Building, MONTREAL; Watson Jack, Manager.
Traders Bank Building, TORONTO; Wm. McKay, Manager.
Union Bank Building, WINNIPEG; W. F. Porter, Manager
Calgary Block, CALGARY; J. F. Porter, Manager.

# "CLIMAX" OAK TANNED LEATHER BELTS

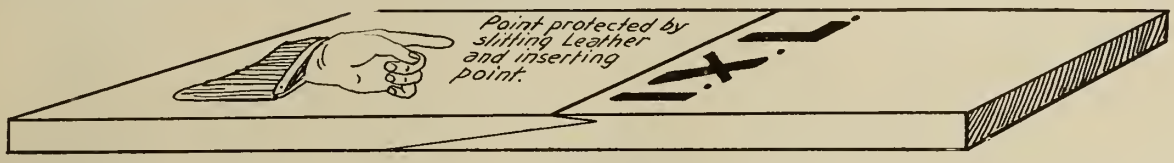
**are still faithfully doing their work long after the price has been forgotten. This is a sufficient argument for far-seeing purchasers.**

**SADLER & HAWORTH** TANNERS AND MANUFACTURERS **MONTREAL**

**33** YEARS IN BUSINESS

Branch Office and Factory: TORONTO
Stock Depots at: ST. JOHN, N.B., WINNIPEG, CALGARY, VANCOUVER

# THE "I.X.L." SPLICE "THE BELTING SPLICE THAT WILL NEVER COME OPEN"



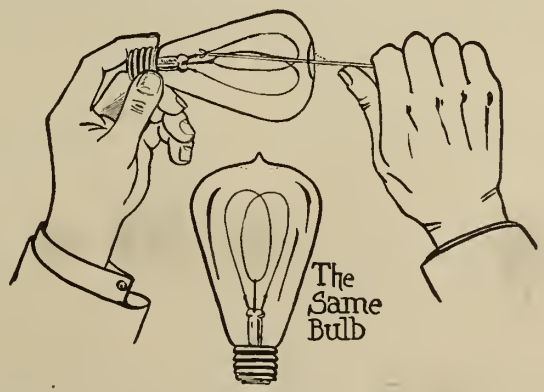

The great trouble with *any* belting—no matter how good the leather—that is joined up with the ordinary splice, is the fact that the splices come open, causing loss and delay. J. D. McArthur's Leather Belting made with the "I.X.L." SPLICE, as shown in this cut, *cannot* come open at the splices. Note the protected point, outside point running same direction as pulley. J. D. McArthur's Leather Belting is made from Prime British Oak-Tanned Leather, from Close-Trimmed Backs exclusively.

Write for our complete price list. J. D. McARTHUR & CO., Brockville, Ontario

Stock at Toronto Branch, 639 King St. East; J. E. Stephenson & Co, Agents

# High-Grade Incandescent Lamps at Remarkably Economical Prices and How they can be Sold so Cheaply

**It is a Sensible Business Proposition Which Means Money to Lamp Users Who Realize What it Means to the Trade**




**The accompanying illustration gives a practical view of our method of renewing burned out incandescent lamps.**

**The lamp is opened from the tip of the bulb only, the remainder being undisturbed. The finished lamp is then as good as new, being clear, durable and efficient.**

**The difference between new and refilled lamps is a matter of price.**

**Besides the very moderate price of our lamps we make a liberal allowance for old lamps.**

**If you will order immediately, and then save and collect Burned-out Lamps, you will find that the profits of the lamp end of your business have increased 100 per cent. or more.**

**THE DOMINION ELECTRIC COMPANY,** EXPERT LAMP REFILLERS **St. Catharines, Ont.**

# Have You Ever Been Fooled?

on a boiler compound. Most engineers have, some time or other. And you are liable to be fooled any time you buy a "stock" compound. A compound, to be of any use, has to be made to meet special feed water conditions. It can only be properly made after feed water has been analysed because feed waters differ in scale forming elements according to the differing geological character of the sources from which they come.

## The Service We Offer

is just this: We will make a free analysis of your boiler feed water if you will send us a sample of it. If we find that your sample contains scale forming elements, we will, if you desire it, make you up some

## "RED STAR" COMPOUND

that we positively guarantee will absolutely remove any scale at present in your boiler and prevent the formation of any more scale.

We do not carry any stock of "Red Star" Compound—every barrel is specially made up after analysis. A five-pound bag of "Red Star" Compound dissolved in two gallons of hot water makes twenty-one pounds of the most effective boiler compound on the market. It will not corrode, rust, pit or otherwise injure any boiler.

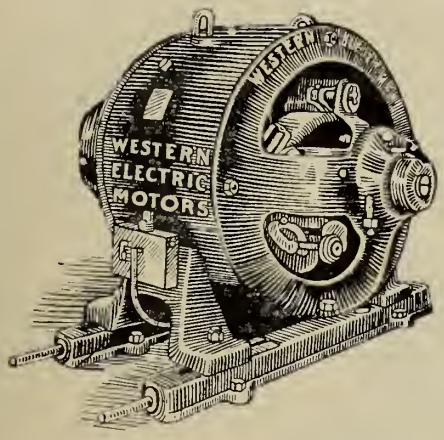
### A Feeder Free!

To Engineers using "Red Star" Compound we will loan one of our Perfection Automatic Back Pressure Boiler Compound Feeders Free of charge. These are the best compound feeders ever invented.

# Hygienic Laboratories, Limited

## 11 Colborne Street, :: :: Toronto, Canada

# No Matter What the Machine is This is the Way to Raise its Efficiency




You can drive any machine harder and rack it less—

You can lessen power-cost considerably —very considerably indeed—

You can eliminate probably as much as fifty per cent. of power waste—with

# Western Electric Hawthorn Motors

which maintain a uniform, unvarying speed whether the load is heavy or light; which economize floor space greatly; which give a most perfect control of stops and starts to the operator; and which are the practical expression of years of designing motors for hard usage and cost reduction. These motors can be supplied for either direct or alternating current.

**You are welcome to Bulletin 3107 for the asking. It goes into this power question in a way that will appeal to you strongly.**

## THE NORTHERN ELECTRIC AND MANUFACTURING CO. LIMITED

**MONTREAL**
Cor. Notre Dame & Guy Sts.

**TORONTO**
60 Front St. W.

Manufacturers and Suppliers of all apparatus and equipment used in the construction, operation and maintenance of Telephone and Power Plants

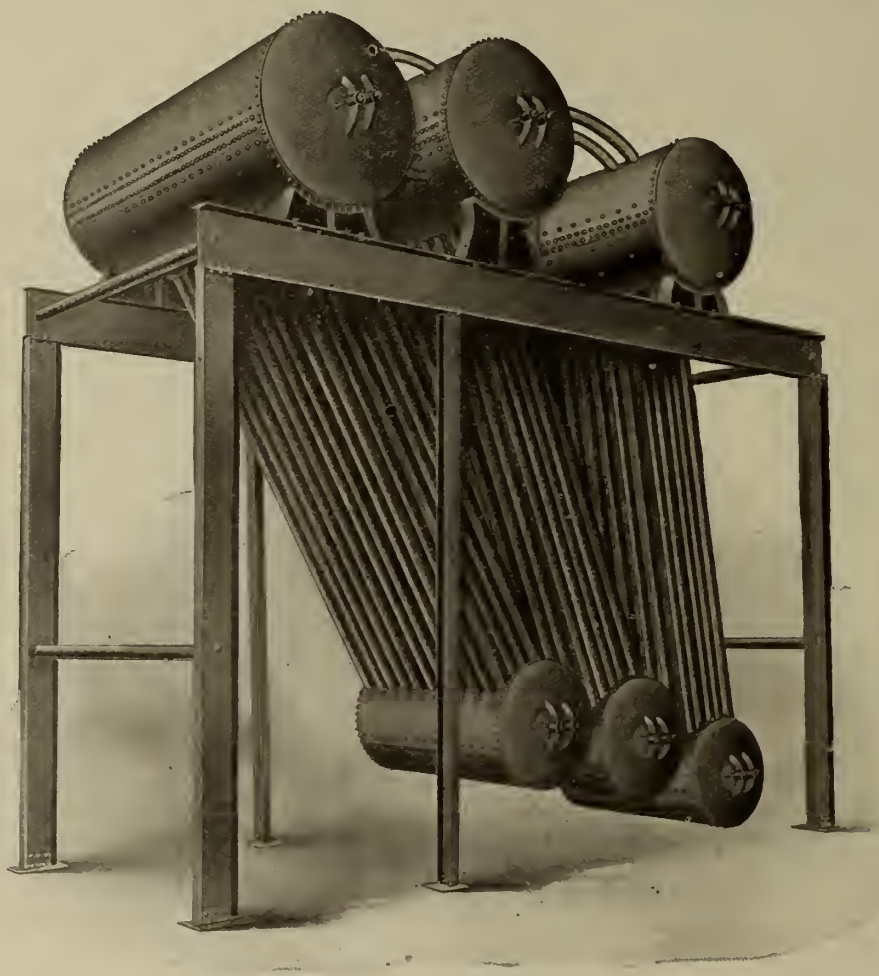
**REGINA**

**WINNIPEG**
599 Henry Avenue.

**VANCOUVER**
424 Seymour St.

# Water Tube Boilers

## Return Tubular, Horizontal Marine, Vertical and Portable Boilers, with or without Wheels



Side View of our NEW WATER TUBE BOILER. Not bricked in.

## Our Engines, Boilers, Heaters, Pumps and Condensers are Prominent in Canada's Largest Power Houses.

## The Goldie & McCulloch Co., Ltd.

### Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

BRITISH COLUMBIA AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Boilers, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

Ask for Catalogues, Prices and All Information.

Power Plant and Dam, Point du Bois, near Winnipeg.

# The Municipal Hydro-Electric Works of Winnipeg, Manitoba

## Hydro-Electric Works now under Construction at Point du Bois Falls, on Winnipeg River, with Transmission and Delivery of Electric Energy.

Staff Correspondence.

The present Public Utilities Company which is operating in and around Winnipeg has a monopoly of such a nature that the municipal authorities have decided not to await the expiration of the present franchises, which would enable the city to assume control of either of these present properties, or to arrange new agreements providing for further control of rates. The only other course logically open was to create competition, for the reason that the cost of fuel in Winnipeg is excessive and does not offer effective means of competition in itself by the private production of electric energy. This competition might have been created by chartering a second company for the production and sale of Hydro-Electric energy, but the history of such efforts has usually been that of amalgamation, and a repetition of monopoly, whether or not such or any monopoly is or is not, when regulated, for the best interests of a city, need not be here discussed, but the decision was reached in 1905 to construct municipal works, for the purpose of creating the competitive condition desired.

In that year a careful examination was made of the hydraulic resources of the Winnipeg River, which has its chief gathering grounds in the lake country of Western Ontario, and which flows through the eastern portion of Manitoba, and empties into Lake Winnipeg, after passing through a rock-ribbed country, very suitable for such works as were contemplated.

The report presented justified the city authorities in making contour surveys of the most promising power sites, which were performed during the following winter, after which followed Engineers' estimates of cost in April, 1908, and a popular vote of $3,250,000 in June, 1906, which indicated clearly the then desire of the property owners of the city, which was to expend the above mentioned sum on municipal Hydro-Electric works.

In October, 1906, the designs for works were begun, and it was then contemplated to complete the same in two and a half years, but some delay has been occasioned by various events, chief of which might be instanced the financial stringency of 1907, which caused a setback of over a year, but the construction is now being vigorously prosecuted, over $500,000 has been expended, and further contracts of over $1,000,000 are now in process of completion, whilst further contracts for equipment, and distribution, are soon to be placed, and it is contemplated to have the works in operation delivering power within the next eighteen months.

### The Instalation.

The undertaking will consist, when completed, of the following:—

(1) A 60,000 h.p. generating station, operating under 45 ft. to 46 ft. of hydraulic head.

(2) A seventy-six mile transmission consisting of four three phase circuits carried on two series of double circuit steel towers with concrete footings.

(3) A terminal station in the city, at which the pressure of the current transmitted will be reduced to 11,000 volts.

(4) An underground cable distribution to sub-stations.

(5) Three, or more sub-stations where the voltage will be reduced to 2,200 volts and 550 volts.

(6) A secondary underground and overhead distribution to customers.

It is proposed to describe briefly the component parts (1) (2) and (3) above enumerated; the distribution has not yet been studied in detail.

### Generating Station.

(1) Generating station at Point Du Bois Falls. Nature has here been beneficent, and the following important features are in evidence:—

(a) A large lake adjacent to the head gates, with consequent favorable operating conditions.

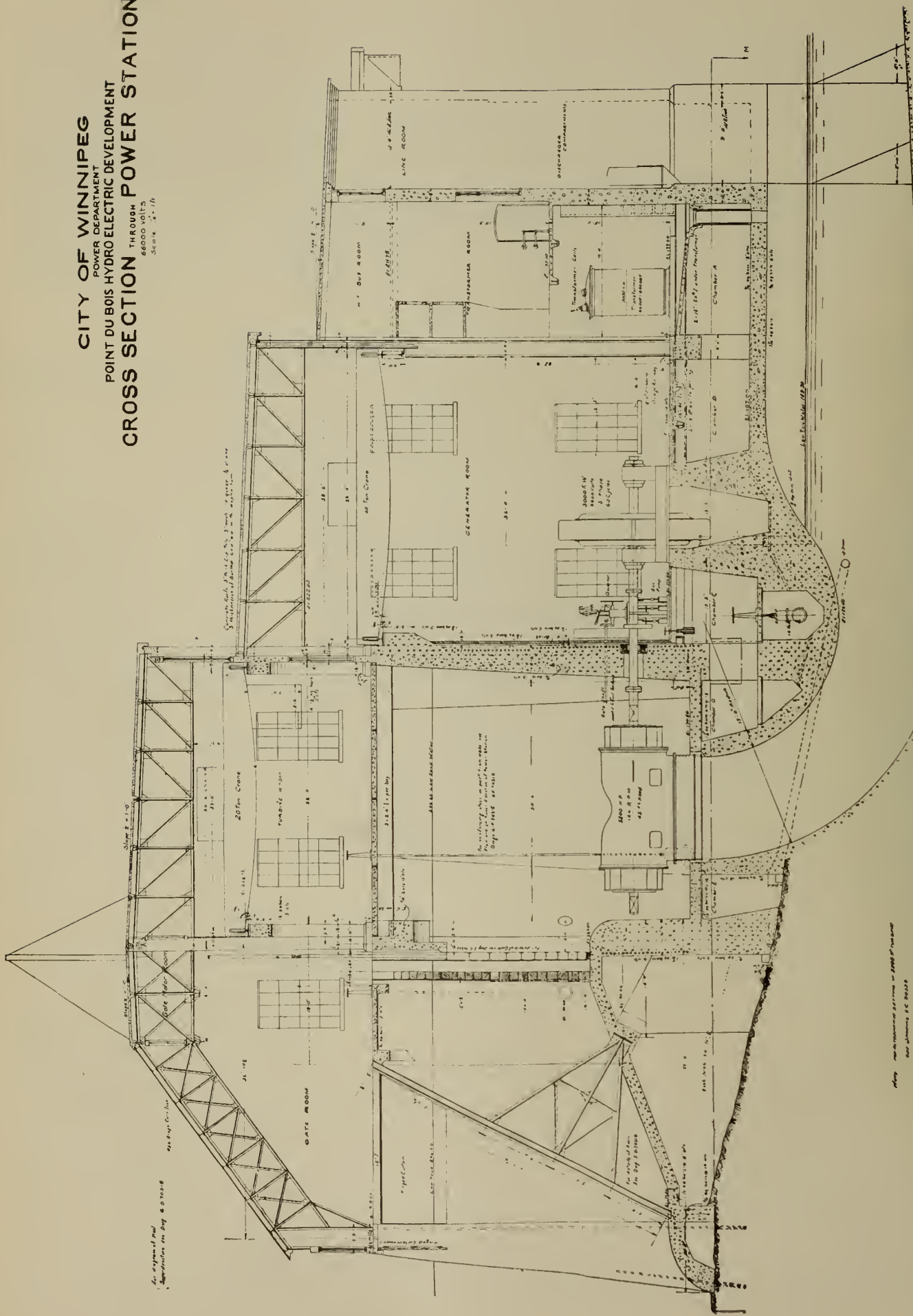
(b) A contour favorable to economical works.

(c) Rock foundations for all constructions.

(d) A difference of hydraulic level, which will be practically constant.

(e) A water free of silt, or any other objectionable matter, either dissolved or in suspension.

After studying various possible designs it was decided to build concrete overflow walls, a rock-filled dam, and a power house with wheel pits built as an integral part of the head block, and a transformer station, also integral with the power house itself. Further consideration of cost and climate gave as a result an enclosed forebay room, and double runner turbine units of 5,200 h.p. capacity each, at a speed of 164 r.m.p., also motor operated head gates protected by stop log arangements—the whole power house being again protected by head gate piers




Cross Section Through Power Station, Winnipeg Power Development, Point du Bois.

in the canal, by which the canal can be unwatered by the use of stop logs.

The generating room will ultimately contain two turbine driven exciters, 250 k.w. each, and two motor driven exciters of the same capacity, and sixteen main generator units of 3,000 k.v.a. each, operating at 6,600 volts, 50 cycles, three phase; of the above five main units and two exciters are to be now installed.

These generating units will be so arranged as to be operative in groups of three per bank in accordance with a similar grouping of the step up transformers. Electric travelling cranes of suitable capacity will be installed in the generator and turbine rooms.

The generating station will be built throughout of reinforced concrete upon plain concrete tailrace walls. A cross section of the building is shown in the cut, upon which will be observed the natural arangement of the equipment and the resulting simplicity of the station design.

### Transmission System.

The transmission system will be constructed upon a one hundred-foot private right-of-way, and by the shortest feasible route. The towers are built up of structural shapes in an economical design and are of two types, braced—in which the spread of the base is about one-fourth the height of the tower—and fllexible, consisting of channel irons supported in a plane normal to the axis of the wires; both types will be supported upon rigid concrete footings.

Each line of towers will support two three phase circuits of aluminum cable mounted upon pin type insulators.

A single circuit telephone line will parallel the transmission line, but upon cedar poles.

### Terminal Station.

The terminal station in Winnipeg will receive power at 60,000 volts, and will deliver it to sub-stations at 12,000 volts by means of a three conductor underground cable system.

The transformers will be of the water cooled type in both generating and terminal stations, but of the water circulating class, in the former, and of the oil circulating type in the latter station.

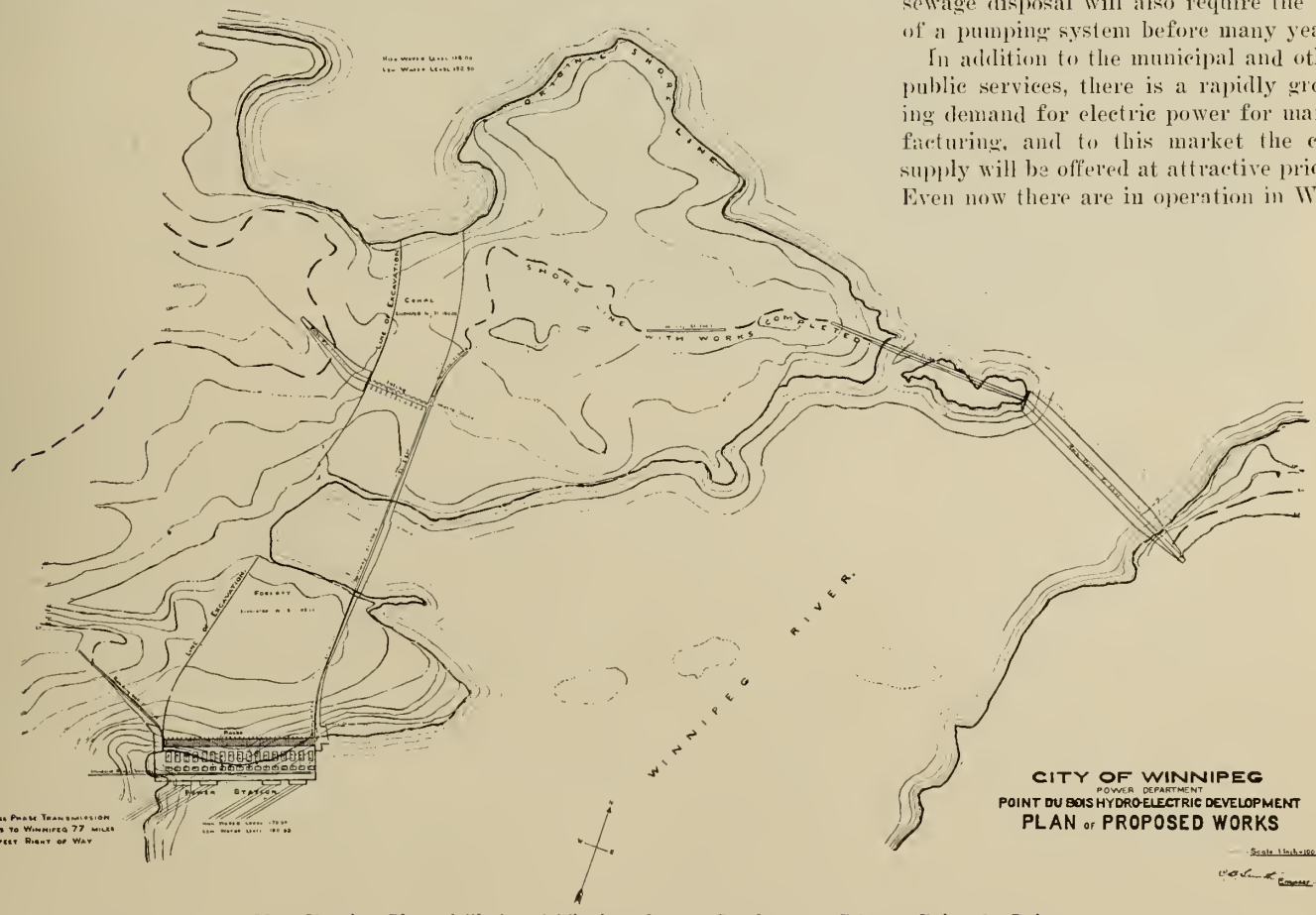
The high tension busbar system in both stations wil be of the open type. In both stations a very complete system of switching will afford the maximum of flexibility.

The accompanying plan will indicate clearly the geographical relation of the Hydro-Electric plant to the City of Winnipeg. It was proven advisable that the railway system existing at the time of beginning work should be extended, and that the site of the works should be made easily accessible. To this end twenty-five miles of standard gauge railway, including two bridges over channels of the Winnipeg River, were constructed. A small equipment, the property of the city, is now in operation thereupon.

Upon completion of construction of the plant, there will be an immediate market for a considerable block of the generated power. The city is widely spread and is rapidly growing. Its street lighting and public services will be supplied, as also will it use its own electric power for pumping its water supply. This supply is obtained from a series of artesian wells, each already equipped with electrically driven pumps, which take about 40,000 horse power. The problems of sewage disposal will also require the use of a pumping system before many years.

In addition to the municipal and other public services, there is a rapidly growing demand for electric power for manufacturing, and to this market the city supply will be offered at attractive prices. Even now there are in operation in Winnipeg steam plants whose aggregate demand approximates fifteen thousand horse power. At the present time there is estimated to be a market in Winnipeg for about 12,000 h.p., in adition to the city requirements.

Upon deciding to invest municipal funds in this Hydro-Electric development, the authorities placed the design and construction in the hands of Cecil B. Smith, Ma. E., Toronto, of the engineering firm of Smith, Kerry & Chace. The City Council has also retained as a Board of Consulting Engineers, Col. H.




Map Showing Plan of Works of Winnipeg Power Development Scheme, Point du Bois.

N. Ruttan, C.E., Winnipeg; William Kennedy, Jr., C.E., Montreal, and Prof. L. A. Herdt, E.E., Montreal.

The contract for the general works at Point du Bois has been awarded to John Green & Sons, Winnipeg, at an estimated cost of $779,100; the contract for the transmission line goes to the Williamson Construction Co., Winnipeg, which has been sub-contracted to the Northern Aluminum Co., Shawinigan Falls, Que., and the Manitoba Iron Works, Winnipeg. The Aluminum contract is at an estimated cost of $148,050; and the steel towers were constructed for at $87,550.

Winnipeg Minature Power Plant at the Industrial Exhibition, Winnipeg.

## MARINE DEVELOPMENTS.

James Mollison, an engineer surveyor of Lloyds, Glasgow, speaking of the introduction of the triple-expansion engine in 1881, said the triple expansion and quadruple expansion engines had practically held the field for a quarter of a century. Now the steam turbine was rapidly superseding the reciprocating engine in fast passenger vessels, and recently a combination of both types had been adopted in one or two instances. A good deal of progress had lately been made, in the face of many difficulties, in improving the internal combustion engine in conjunction with producer gas, so that it might be safely and economically used for marine purposes, while for special trades oil had been tried, with satisfactory results. In the early eighties the steamer Strathleven, of Glasgow, was fitted with cold air compression refrigerating machinery, and she brought over to this country a pioneer cargo of colonial meat. In 1879, however, the Circassia, also of Glasgow, had brought a cargo of chilled meat from the United States. The machinery was manufactured by Messrs. D. and W. Henderson & Co., the system being the Bell-Coleman, which did much to lay the foundation of our present cold storage system.

## MANITOBA POWER LINE.

The extent of the exploitation of electrical power throughout Manitoba by the Great Falls Power Co., and the cities and towns that are included in the scheme, can be undestood by the accompanying map.

The extent of the available power at Great Falls on the Winnipeg river is conservatively computed at 250,000 horse power, and negotiations are now pending with every municipality on the route for the service.

Upon completion of these negotiations the Great Falls Power Co. announce that work will be begun so that the transmission of electrical power will be an accomplished fact in 1911, two years from the present summer.

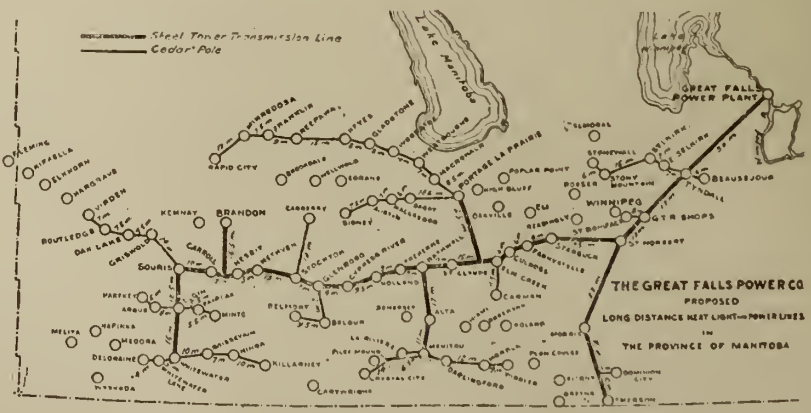
The accompanying table shows the prospective rates and the economic advantages to be derived by municipalities and local industries.

Prospective rates of the Great Falls Power Co., which they believe can be sold and the prices realized for same in the Province of Manitoba, at the completion of their plant in 1911.

| Town | Distance from power plant. | Probable requirements. | Probable rate. |
|---|---|---|---|
| Tyndall | 44 | 200 | $21.00 |
| Beausejour | 49 | 500 | 21.00 |
| Selkirk | 48 | 1,000 | 19.00 |
| Stony Mountain | 66 | 200 | 21.00 |
| Stonewall | 72 | 1,000 | 20.00 |
| St. Boniface | 62 | 5,000 | 17.50 |
| St. Norbert | 70 | 50 | 22.50 |
| Elm Creek | 113 | 50 | 24.00 |
| Carman | 125 | 500 | 22.50 |
| Treherne | 145 | 500 | 24.50 |
| Holland | 163 | 100 | 25.00 |
| Cypress River | 163 | 100 | 25.50 |
| Glenboro | 172 | 200 | 25.50 |
| Stockton | 180 | 100 | 25.50 |
| Souris | 217 | 1,000 | 24.50 |
| Oak Lake | 237 | 200 | 27.50 |
| Virden | 252 | 1,000 | 26.00 |
| Carberry | 200 | 500 | 25.00 |
| Brandon | 225 | 6,000 | 22.00 |
| Deloraine | 256 | 800 | 27.00 |
| Boissevain | 256 | 1,000 | 26.00 |
| Killarney | 276 | 1,000 | 27.00 |
| Ninga | 265 | 50 | 29.50 |
| Argue | 238 | 200 | 27.50 |
| Hartney | 243 | 1,000 | 25.50 |
| Elgin | 230 | 300 | 27.50 |
| Fairfax | 239 | 100 | 27.50 |
| Minto | 245 | 100 | 27.50 |
| Baldur | 165 | 100 | 25.50 |
| Belmont | 193 | 100 | 26.00 |
| Morris | 103 | 200 | 22.00 |
| Emerson | 130 | 1,000 | 22.00 |
| Dominion City | 127 | 200 | 23.50 |
| Portage la Prairie | 137 | 4,000 | 21.00 |
| Westbourne | 153 | 100 | 24.50 |
| Gladstone | 171 | 500 | 25.00 |
| Neepawa | 196 | 1,000 | 24.00 |
| Minnedosa | 210 | 500 | 27.00 |
| Rapid City | 223 | 300 | 27.00 |
| MacGregor | 158 | 800 | 25.00 |
| Austin | 156 | 50 | 26.00 |
| Sidney | 175 | 50 | 26.50 |
| Manitou | 167 | 300 | 25.00 |
| Crystal City | 190 | 200 | 26.00 |
| Darlingford | 176 | 100 | 25.00 |
| Morden | 189 | 1,000 | 24.00 |
| Winkler | 197 | 200 | 26.00 |
| Grand Trunk Shops | 55 | 1,000 | 19.00 |
| Pilot Mound | 190 | 200 | 26.00 |
| | ... | 34,100 | ..... |
| Average | | | $22.34 |

J. J. Ashworth, sales manager of Canada Foundry Co., has been appointed assistant general manager of the Canadian General Electric Co., Toronto.

R. T. MacKean, until recently factory manager for the R. E. T. Pringle Co., Montreal, has been appointed eastern sales manager for the electrical department of Canadian Fairbanks Co., with headquarters at Montreal.




Proposed Long Distance Heat, Light and Power Lines in Manitoba.

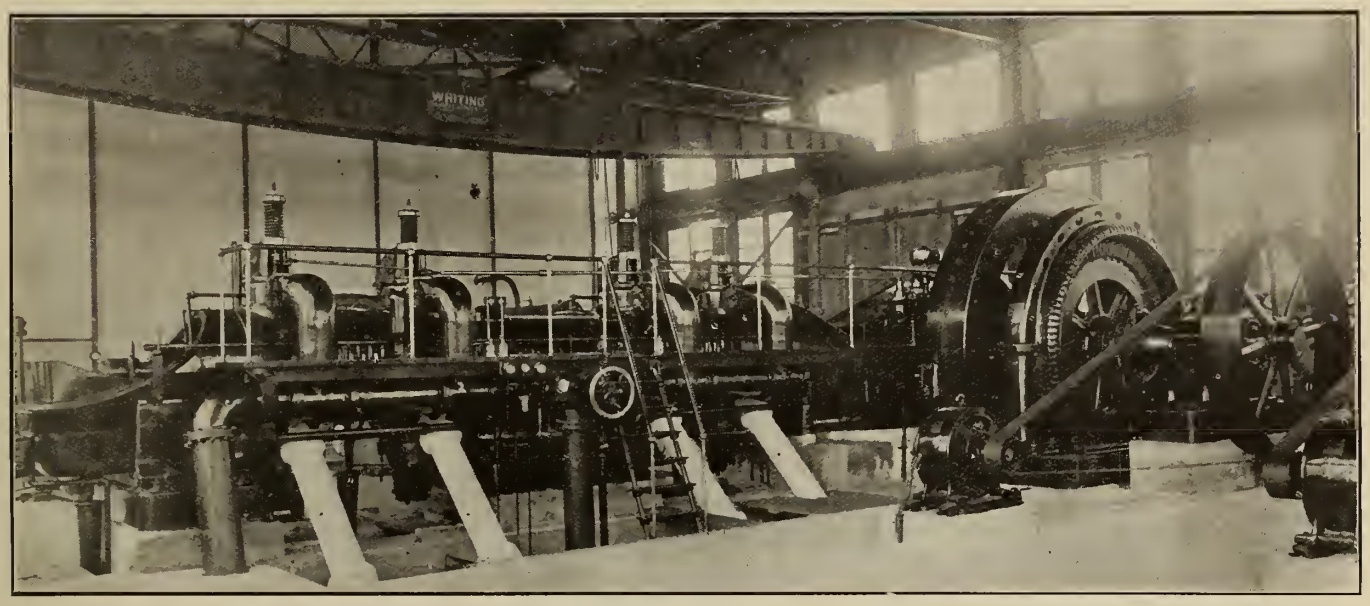


Fig. 1.—Generator Side of 500 h.p. Westinghouse Gas Engine in the Power House.

# The Producer Gas Power Plant at the I.C.R. Shops, Moncton

## An Up-to-date Instalation, Containing the Largest Single Unit Gas Engines at Present Installed in Canada—A Brief Description of Producers, Etc.

Staff Correspondence.

That gas power is rapidly becoming a factor in large power producing plants in Canada is again demonstrated by the recently finished instalation in the I.C.R. shops at Moncton. Here power is generated in a central station and transmitted to the various motors in the different shops. The gas is generated from bituminous coal in a building separated about 150 feet from the engine room. Steam is used to heat the buildings, drive the various pumps and the air compressor outfit.

The engine and boiler rooms are each 100x69 feet, under one roof, but separated by a reinforced concrete wall. The construction is steel, and reinforced concrete. The columns are imbedded in concrete pilasters and the concrete roof is supported by steel trusses. The sides are practically all glass, giving plenty of light and the height is such that good ventilation is assured. The floor is of patented "Terrano" construction, material for which was supplied by the Eadie-Douglas Co. This makes an admirable floor, pleasing to the eye and very easily kept clean. The boiler room floor is of tar macadam, laid on a 6 inch course of gravel, well rammed and rolled.

### Engine-room.

The largest single unit gas engines in Canada comprise the main source of power. There are two of these, each being a 500 horse power, Westinghouse, tandem cylinder double acting four stroke cycle engine, running 150 revs. per minute on producer gas. The cylinders are 23 inches in diameter with 33 inch stroke. The weight of each engine, including shaft and generator, is about 90 tons. The cooling system is the ordinary circulating water system in vogue on small engines with the addition of a device for circulating the cooling water through the pistons. The pump supplying this circulating water for the engines and air compressor is a 300 gallon Fairbanks-Morse duplex steam pump, 8"x7"x12". A Richardson sight feed oil pump (on each gas engine) supplies oil under pressure to the pistons, packing boxes and exhaust valve stems. The other parts are oiled by gravity from a tank suspended in the roof trusses. The oil is collected in the basement and returned by a pump driven from the lay shaft by a set of mitre gears and shaft. This shaft can be seen in Fig. 10 running down through the floor. The engines are controlled by Hartung governors employing a sensitive oil relay system designed to relieve the governor of all valve work. They are easily started by compressed air at 75 pounds per square inch furnished by a compressor in the basement. This compressor is driven by a Brown & Cochrane gas engine.

There is a double, make and break ignition at each end of each cylinder, which is connected to a "tell-tale" box consisting of an arrangment of spark coils which raise a flap every time a spark is made. This arrangement allows of close observation of the action of the ignition service. Current for ignition is supplied by a ¼ k.w. motor-generator set, which derives its current from the exciter bus bars on the main switch board.

Direct connected to the engines are the Westinghouse generators. Each is 300 k.w. capacity delivering a 220-volt 3-phase 60-cycle alternating current. The exciters are belted from pulleys on the outside of the out-board bearings. These are 17 k.w. Westinghouse machines running at 1125 revs. per min. The direct current for the cranes and variable speed motors throughout the shops is derived from a 200 k.w., 220-volt Allis-Chalmers-Bullock motor-generator set running at 575 revs. per min. For auxiliary purposes there are two 105 k.w. Canadian General Electric generators direct connected to 125 h.p. Robb-Armstrong engines.

The main air compressor outfit shown in Fig. 1 is a type BB3, compound Rand-Corliss engine, direct connected to a cross compound Rand-Corliss compressor. The capacity of this unit is 2027 cu. ft. of free air per minute at 85

revolutions, and 125 pounds per square inch steam pressure. The air is delivered at 125 pounds per square inch. A distinctive feature of the compressor is the Rand-Corliss valve gear on the low

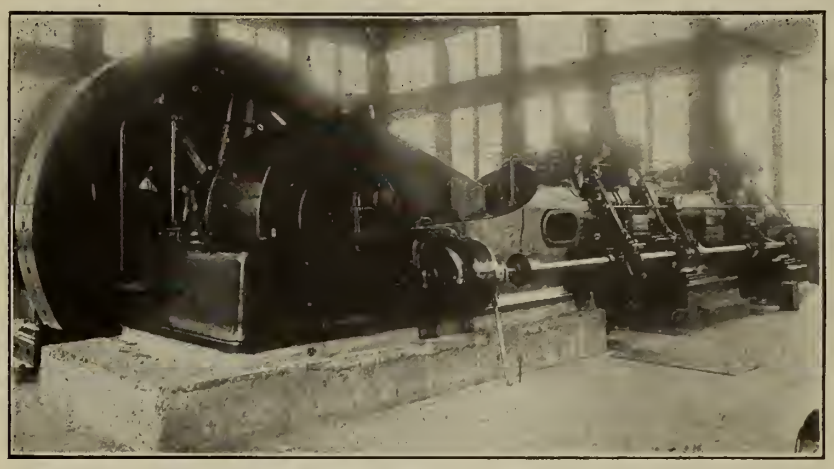


Fig. 2.—Valve Gear of 500 h.p. Westinghouse Gas Engine in the Power House.

press air cylinder. This gives an unrestricted area of intake valve equal to 12 per cent. of the piston area. The sizes of the cylinders are 16 inch and 30 inch at the steam end, and 27 inch and 16 inch at the air end, with 36 inch stroke.

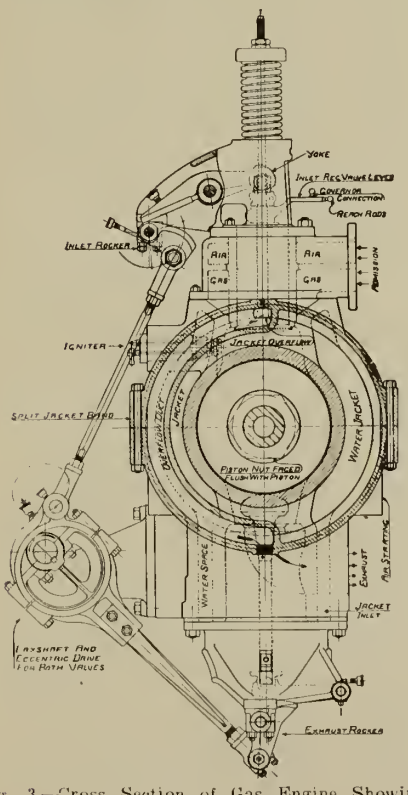



Fig. 3.—Cross Section of Gas Engine Showing Inlet and Exhaust Valve Gear.

For fire purposes there is a Smart-Turner Machine Co.'s underwriters double compound pump, having a capacity of 1,000 gallons per minute. There is also a Smart-Turner high pressure pump 7½"x3¾"x10" for supplying the pressure used in testing the boilers, etc. The engine room is served by a Whiting crane, supplied by the Dominion Foundry Supply Co. This is a 16-ton hand power traveling crane, carrying a Yale & Towne chain block operated, by pendant hand chain, from the floor.

The switchboard, Fig. 4, when completed will have sixteen panels of No. 1 Blue Vermont marble, each 96"x26", with a swinging panel on the end carrying two volt metres, power factor meter and synchronscope. The instruments are of Westinghouse make and the whole is very proportionately designed and convenient. There are four Cooper-Hewitt mercury vapor lamps for the main lighting system.

**Boiler Room Equipment.**

The present capacity of 1,000 horse power is furnished by four 250 h.p. Babcock & Wilcox water tube boilers in two batteries and space is provided for an additional battery. The boilers are fired by Babcock & Wilcox patented improved chain-grate mechanical stokers the hoppers of which are fed by hand from the coal bins in front of the boilers.

The boilers are fed by two methods, one covering the returns from the live steam heating and the other covering the make-up water. The live steam returns are all carried by the Bundy trap system direct to a small closed receiver suspended above the boilers. These returns are kept under pressure so as to lose no heat through expansion. From this receiver the water runs to two large Bundy return traps capable of discharging into the boilers 36,000 pounds of water per hour, if necessary.

All the exhaust returns are automatically carried, by Bundy pump traps, to the general hot well from which the two-feed pumps draw the water necessary to maintain the water level in the boilers. The purification of the exhaust returns takes place in the hot well and the pumps feed the boilers through a Babcock & Wilcox vertical water tube heater. This heater has a capacity of 21,000 pounds of water per hour, contains 319 square feet of heating surface and gives a feed temperature of about 210 deg. F. with three pounds back pressure on the exhaust. The heater is warmed by the exhaust from the air compressor engine and the pumps. The feed pumps are 10"x6"x12" duplex, outside packed plunger type, supplied by the Smart-Turner Machine Co.

Each boiler is provided with a Berry automatic safety boiler feed regulator, which automatically control a pump governor on the feed pumps, and maintain the water level of the boilers within a half inch of the desired point. By this system of feeding, very considerable economies will be effected as it is estimated that the water from the live steam returns will go back into the

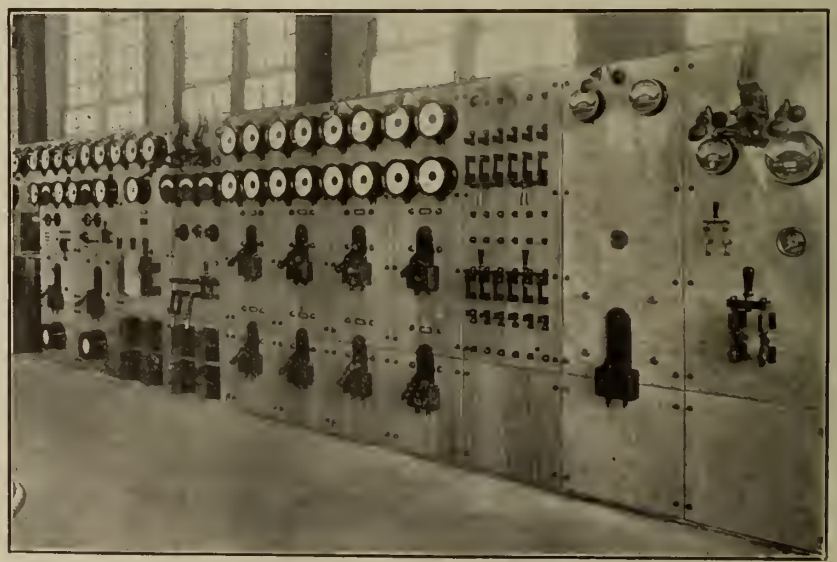


Fig. 4.—Switch Board in the Power House of the I. C. R. Shops, Moncton.

boilers at a temperature of 255 to 260 degrees F. The Bundy traps and feed water control were supplied by Peiler & Mackenzie, Montreal.

**Heating and Return Systems.**

The heating system for the freight car repair, smith and erecting shops is situated in the boiler-room. The rest of the shops have their own independent heating systems. These are the indirect hot blast Sturtevant system with the exception of the stores and office building, which is steam heated by direct radiation. The fans and blowers were also furnished by the Sturtevant people. The hot air is forced through concrete conduits to the risers in the walls of the buildings. These discharge close to the floor near the windows.

The fans for the heating system and induced fraft are all direct connected to their own individual engines. Two Cooper-Hewitt mercury vapor lamps are used for lighting the boiler room.

**Producer House and Equipment.**

This building is a steel frame structure with reinforced concrete walls and roof slab. It is of one storey with a basement with floors of steel and concrete respectively.

The apparatus was supplied by the R. D. Wood Co. There are two retorts or generators, having a combined capacity of 1,000 pounds of bituminous coal per hour, or 1,500 pounds for not more than three hours. The output is 55 cubic feet of producer gas or 18 cubic feet of water gas per pound of coal. The water gas is used in the various furnaces throughout the shops, while the engines take the producer gas. By a well arranged system of hydraulically operated valves the two forms of gas are made intermittently. Gauges connected to the holders warn the attendent of the supply in each. There is a holder having a capacity of 10,000 cubic feet for each kind of gas.

The retorts are fed from the floor level through the openings A (Fig. 7). From the retorts the hot gases pass up through the vertical boiler B. This is used to generate the steam used in driving the exhauster engine. The pipe C conveys the gas to the bottom of the vertical scrambler through which it rises past and over wooden slats placed in a zig-zag position. Beneath the letter D (Fig. 7) can just be seen the rotary scrubber or centrifugal tar extractor, which is driven at 1120 revolutions per minute by a Westinghouse motor direct connected through a flexible coupling. A Root exhauster, (E) direct connected to a New York Safety Steam Power Co's. engine, takes the gas from the rotary scrubber and delivers it to the holders at a pressure of 3 inches of water.

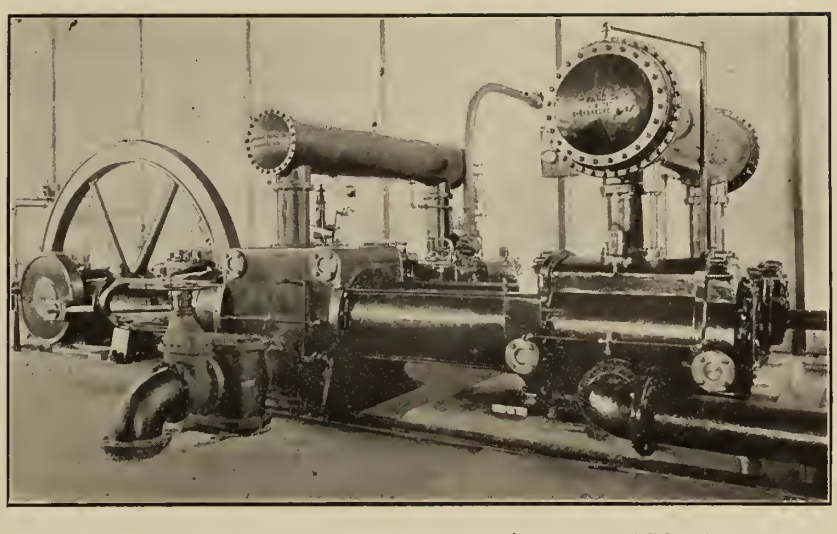


Fig. 5.—Canadian Rand Air Compressor in the Power Plant of the I.C.R. Shops, Moncton.

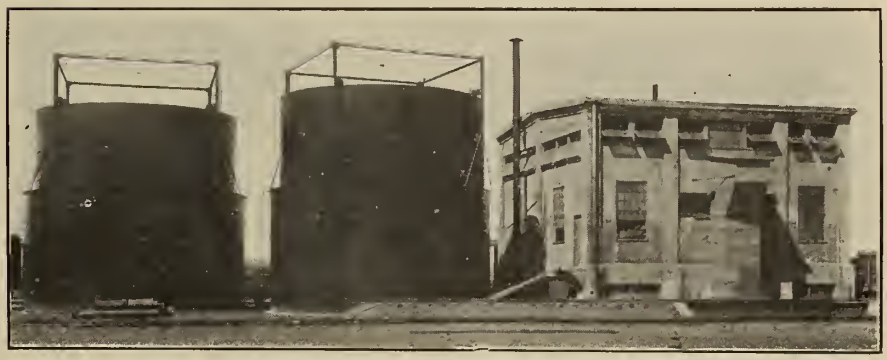


Fig. 6.—Exterior Gas Producer Plant, I. C. R. Shops, Moncton.

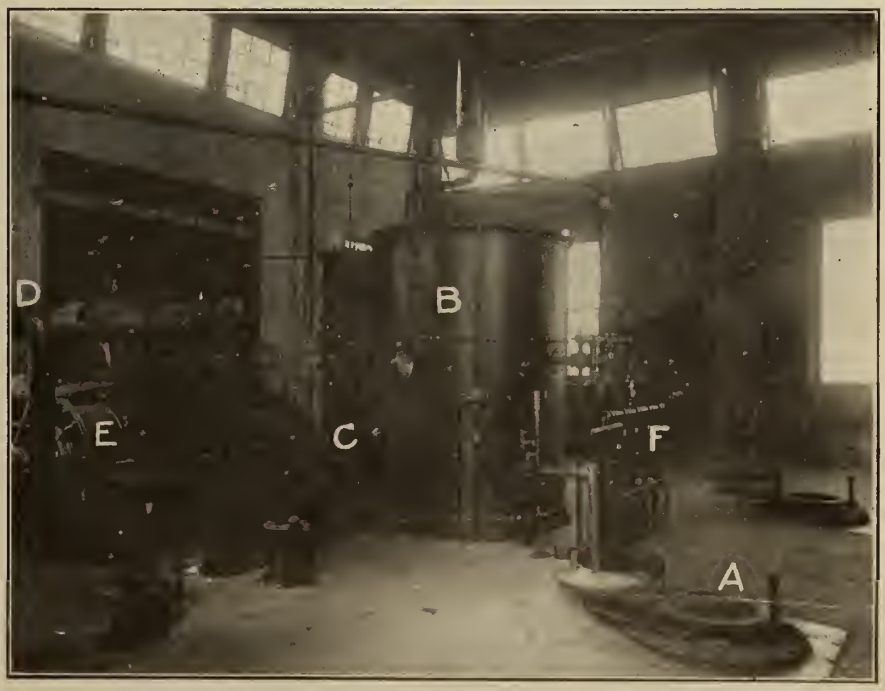



Fig. 7.—Interior of Gas Producer House (Main Floor) I.C.R. Shops, Moncton.

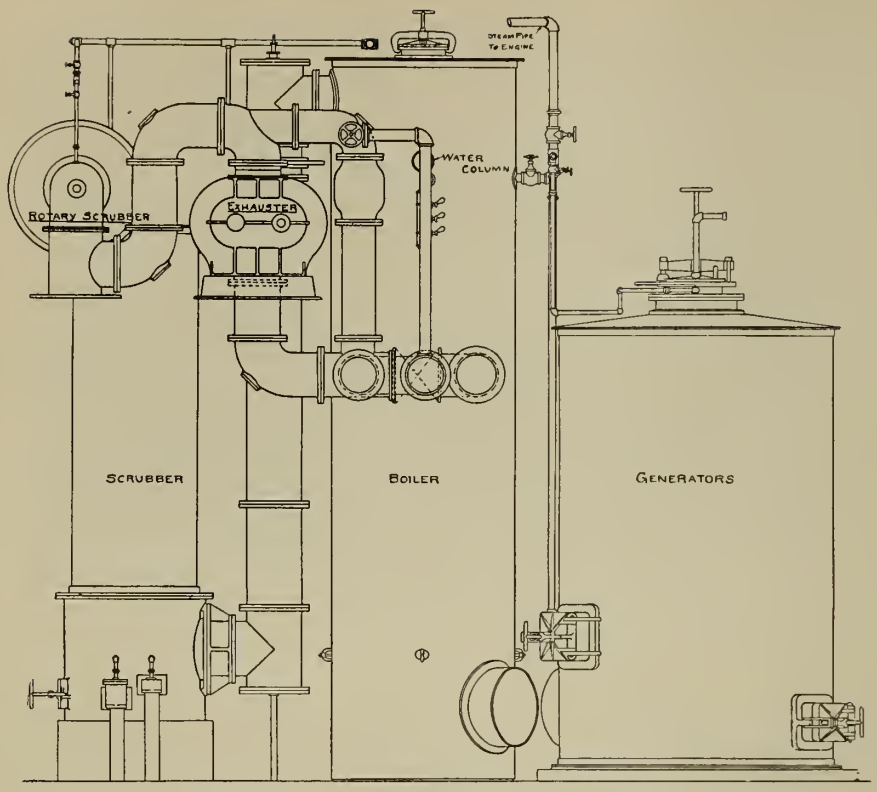



Fig. 8.—Side Elevation of Double Generator Water Gas Plant, I.C.R., Moncton.

At F are the levers which control all the hydraulically operated valves used in switching the retorts from producer to water gas. The producers are making producer gas for the engines the greater part of the time, in the ratio of producer gas for about five minutes and water gas for about a minute to a minute and a half. The retorts are connected at the top and the water gas passes up through one retort across to and down through the other and thence follows the path described above. There are two gas holders of 10,000 cubic feet capacity each, one for each kind of gas.

## N. S. SOCIETY OF ENGINEERS.

The third annual meeting of the Nova Scotia Society of Engineers was held in New Glasgow Sept. 9 and 10, 1909. The following is the programme:

September 9.—Business meeting, 2.30 to 5.30. Evening session for the reading and discussion of papers. R. W. McKenzie gave "Some Memoranda on Land Surveying in Nova Scotia." This was followed by papers on "Forest Conservation," by Prof. Sexton; "Forest Preservation," by C. M. Odell; "Relation of Forests to Stream Flow," by D. McD. Campbell, and "The Timber Asset of Nova Scotia," By A. R. McLane.

Papers were discussed on the morning of Sept. 10. In the afternoon a visit was made to McNeil's Bridge Works, N. S. Steel Co.'s works, followed by a trip down the river to inspect the dredge Northumberland.

The secretary, S. Fenn, reported a total of 146 members, being an increase over the previous year. The treasurer's report shows a balance of $216.72.

## GAS ENGINE POWER INCREASING.

It is difficult to say when a gas engine becomes a large gas engine. A few years ago 300 horse-power was considered the starting point, then 500 horse-power, and now in a recent article published in a German paper 1,000 horse-power seems to be taken as the minimum. The list gives the names of 28 makers, 19 on the continent, four in England and five in the United States. Altogether it adds up a total of 628 engines, giving a combined output of 1,035,709, or more than 1,000,000 horse-power in large units.

## IT WILL SUIT HIM.

Editor, The Power House.

Enclosed find $1.00 for The Power House commencing with the number which you think will be the most beneficial in the way of getting lessons on engines and boilers for Stationary Engineers. For this reason I send for The Power House.

WILLIAM CALCOTT.

Coals which smoke badly give efficiencies 3 to 5 per cent. lower than coals burning with little smoke.

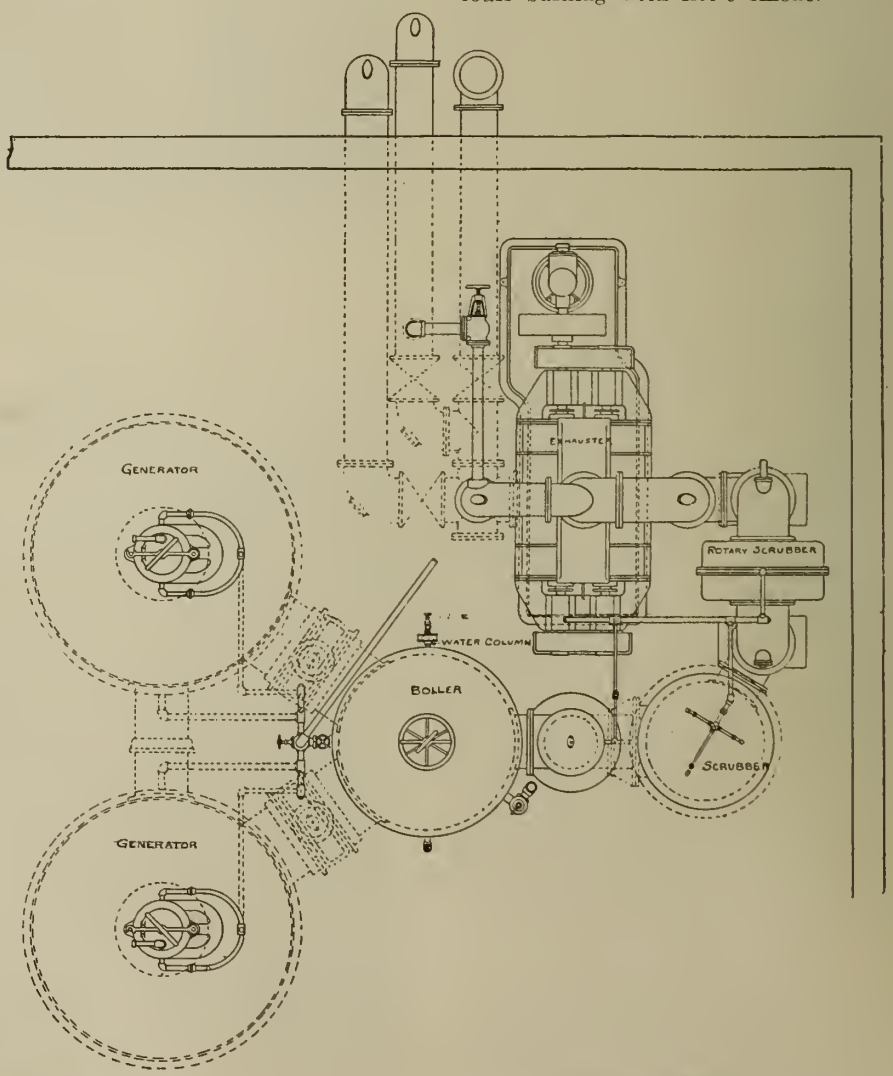



Fig. 9.—Double Generator Water Gas Plant, I.C.R., Moncton.

## LEATHER BELTING.

William O. Weber, Boston, who presented at one of the recent meetings of the National Association of Cotton Manufacturers a paper relating to the measurement of power required for the operation of cotton machinery. The following notes related to belting:

Good oak-tanned leather from the back of the hide weighs almost exactly one avoirdupois ounce for each one-hundredth of an inch in thickness, in a piece of leather one foot square, so that

| Nomenclature. | Weight per sq. ft. | Approx. Thickness. | Actual Thickness. | Nearest Vulg. Fraction. |
|---|---|---|---|---|
| Single belt | 16 oz. | 1-6 | 0.16 in. | 5-32 |
| Lt. dou. . | 24 oz. | 1-4 | 0.24 in. | 15-64 |
| Medium . | 28 oz. | 5-16 | 0.28 in. | 9-32 |
| Standard. | 33 oz. | 1-3 | 0.33 in. | 21-64 |
| 3-ply . . . . | 45 oz. | 9-16 | 0.45 in. | 29-64 |

Assuming an average working strain of 33 pounds per square inch, and using the rule for velocity in feet per minute for each inch in width to transmit one horse-power.

Rule—Multiply the denominator of the fraction expressing the thickness of the belt in inches by 100, and divide it by the numerator:

$$\frac{d \times 100}{n};$$

$1\text{-}6 = 6 \times 100 = 600$ feet.

$1\text{-}4 = 4 \times 100 = 400$ feet.

$5\text{-}16 = \frac{16 \times 100}{5} = 311.5$ feet.

$1\text{-}3 = 3 \times 100 = 300$ feet.

$9\text{-}16 = \frac{16 \times 100}{9} = 177.7$ feet.

If, however, we use the actual thickness as expressed decimally, the reciprocal of such numbers times 100 changes the values as follows:

| | Vel. per In. for 1 H.P. | | Vel. per In. for 1 H.P. |
|---|---|---|---|
| Single ..... ..... .....600 | ft. | | 625 ft. |
| Light double ... ... .. 400 | ft. | | 416.6 ft. |
| Medium double ... .....312.5 | ft. | to | 357 ft. |
| Standard double ... ...300 | ft. | | 303 ft. |
| 3-ply ..... ..... .....177.77 | ft. | | 222 ft. |

so that the safe working strain per inch in width would be as follows:

| | | | |
|---|---|---|---|
| Single | 52.8 lbs. | | 55 lbs. |
| Lt. dbl. | 78.1 lbs. | | 82.5 lbs. |
| Medium dbl. | 92.5 lbs. | Instead of | 103 lbs. |
| St'n'd dbl. | 109 lbs. | | 110 lbs. |
| 3-ply | 148 lbs. | | 185.5 lbs. |

and the safe load on o 12-in. belt running at 1,000 ft. per min. would be:

| | Lbs. | Instead of Lbs. | Or Per cent. |
|---|---|---|---|
| Single .. ....19.2 | | 20 | 96 |
| Light dbl. .. | 22.8 | 30 | 96 |
| Medium dbl. | 33.6 | 38.4 | 87.5 |
| Sta'n'd dbl. . | 39.7 | 40 | 99 |
| 3-ply ... ... | 54 | 67.6 | 80 |

of its former value, showing slight differences except in the medium, double and 3-ply cases.

Good, well-calendered rubber belting made with 30-ounce duck and new (i.e., not reclaimed vulcanized) rubber will be as follows:

| Nomenclature. | Approximate Thickness. | Nearest Vulgar Fraction. |
|---|---|---|
| 3-ply | 0.18 in. | 3-16 |
| 4-ply | 0.24 in. | 15-64 |
| 5-ply | 0.30 in. | 19-64 |
| 6-ply | 0.35 in. | 11-32 |
| 7-ply | 0.40 in. | 13-32 |
| 8-ply | 0.45 in. | 29-64 |

The thickness of rubber belt does not necessarily govern the strength, but the weight of duck does and with 30-ounce duck, as above, the safe working strains may be taken as follows:

| Nomenclature. | Safe working Strain for 1 in. Width. | Vel. per in. for 1 H.P. |
|---|---|---|
| 3-ply | 45 lbs. | 735 ft. p.m. |
| 4-ply | 65 lbs. | 508 ft. p.m. |
| 5-ply | 85 lbs. | 388 ft. p.m. |
| 6-ply | 105 lbs. | 314 ft. p.m. |
| 7-ply | 125 lbs. | 264 ft. p.m. |
| 8-ply | 145 lbs. | 218 ft. p m |

and the safe load on a 12-in. belt runing at 1,000 ft. per min. on a 180-degree contact would be:

| | H.P. |
|---|---|
| 3-ply ... ... ... ... | 16.3 |
| 4-ply ... ... ... ... | 23.6 |
| 5-ply ... ... ... ... | 31 |
| 6-ply ... ... ... ... | 38.2 |
| 7-ply ... ... ... ... | 45.6 |
| 8-ply ... ... ... ... | 52.7 |

Should the arc of contact on the smaller pulley be less than 180 degrees, the tabulated results should be multiplied by the following per cents.:

90 deg. by .50 per cent; 100 by .57; 110 by .64; 120 by .70; 130 by .76; 140 by .82; 150 by .87; 160 by .92; 170 by .96.

---

The notable successes of wireless telegraphy in procuring speedy assistance for ships in distress at sea in spite of fog and distance, best exemplified by the cases of the "Republic" and the "Ivernia," has caused an application for lower insurance rates for vessels equipped with wireless apparatus to be proposed for the international marine insurance congress at Baden next month. Success of the application should be mutually beneficial, both effecting a saving in insurance cost to shipowners using wireless and extending the use of the latter.

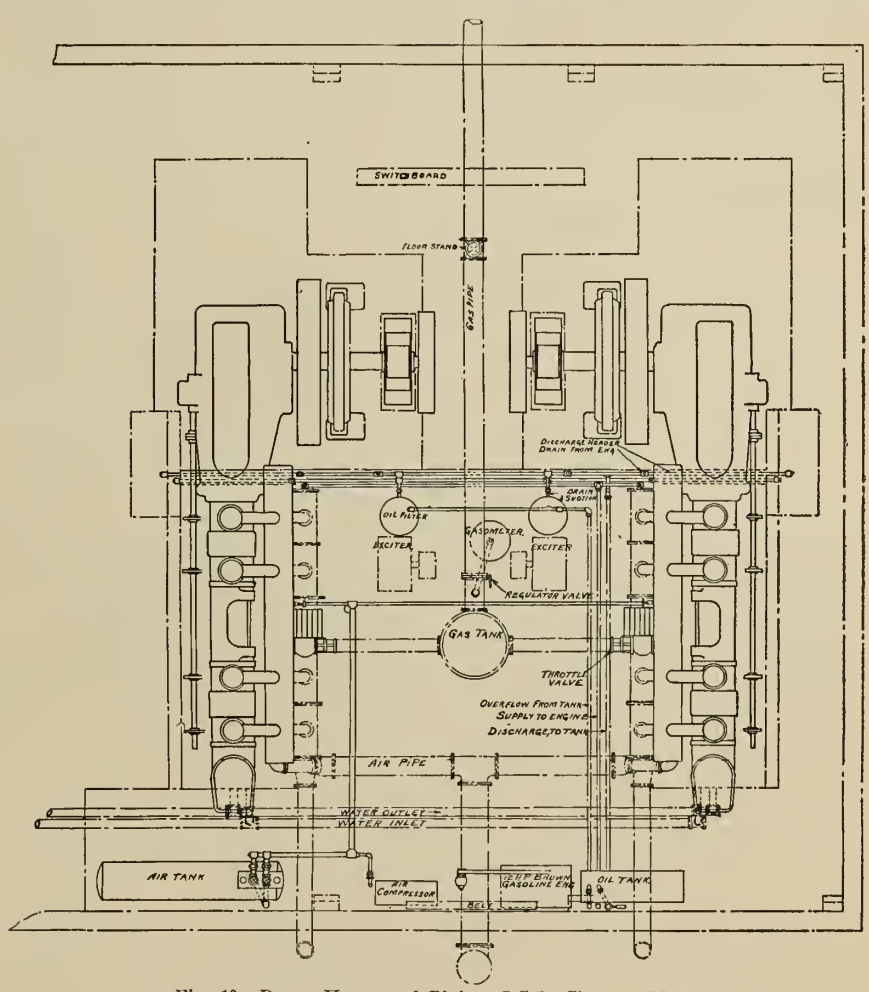



Fig. 10.—Power House and Piping, I.C.R. Shops, Moncton.

# The Westinghouse-Parsons Turbine; Toronto Instalation

## The Fitness of the Steam Turbine for Heavy Power Service—Westinghouse-Parsons Turbines in the John Street Pumping Station, Toronto.

Staff Correspondence.

There are at present few subjects productive of more discussion in the world of engineering than the comparative merits of gas engines, steam engines, and steam turbines. These, together with the hydraulic turbine, constitute our stock of prime movers; each has more or less clearly defined fields of usefulness, which, however, unfortunately overlap. Leaving out of consideration the limited application of the water turbine, the battle royal is on in earnest between the gas engine, the steam turbine and the reciprocating steam engine which for nearly two centuries has held undisputed sway in the field of power production on a large scale.

In recent discussions before technical societies on the general subject in hand, the keynote of thought and criticism has been the reliability and fitness of the steam turbine for the general and specific duties for which it is advocated by its supporters. Operative efficiency has for the moment been accorded a position of secondary importance. This is natural and pertinent. However efficient a prime mover, if, through general complications, doubt exists as to its ability to perform its duties continuously, the cautious engineer feels compelled to supersede it by "the good old reliable" even though less efficient engine.

Up to the time of its introduction by Parsons and DeLaval, the utilization of steam for power work had been entirely through direct expansion in the cylinder of the reciprocating engine. The idea of employing the kinetic energy of a steam jet was not new, but not until demonstrated by Zeuner was the fact fully appreciated that the energy available in a properly directed steam jet is equal to that to be derived from direct expansion in a piston engine, provided that in both cases the steam expanded through the same range of temperature and pressure. This is, of course, a purely theoretical relation, and is only approximated in practice.

In many respects the steam turbine presents a direct parallel to the hydraulic turbine.* Both employ nozzles or guide vanes to direct the moving fluid against rotating vanes mounted upon the periphery of a supporting spider, these vanes being in such form and position as to convert the greatest percentage of the inherent energy of the fluid into useful torque on the shaft. A radical difference, however, between the two forms of turbines lies in the charplace: first, heat energy is expended in expansion and in producing high steam velocity; second, kinetic energy of the steam jet is transformed into useful work through impulse, reaction, or both. The second conversion alone presents a parallel case to that of the hydraulic turbine. Water, during its discharge through a turbine, remains at practically constant volume, but that of steam increases rapidly in expanding from boiler to condenser pressure; for instance, one cubic foot of saturated steam at 200 pounds pressure expands 154 times to 28 inches vacuum and 340 acteristics of their respective working fluids, one being expansive and the other practically non-expansive. In the steam turbine, two energy conversions take times to 29 inches vacuum. Further, by reason of the lower density of steam, high velocities must be dealt with in order to obtain best theoretical efficiency.**

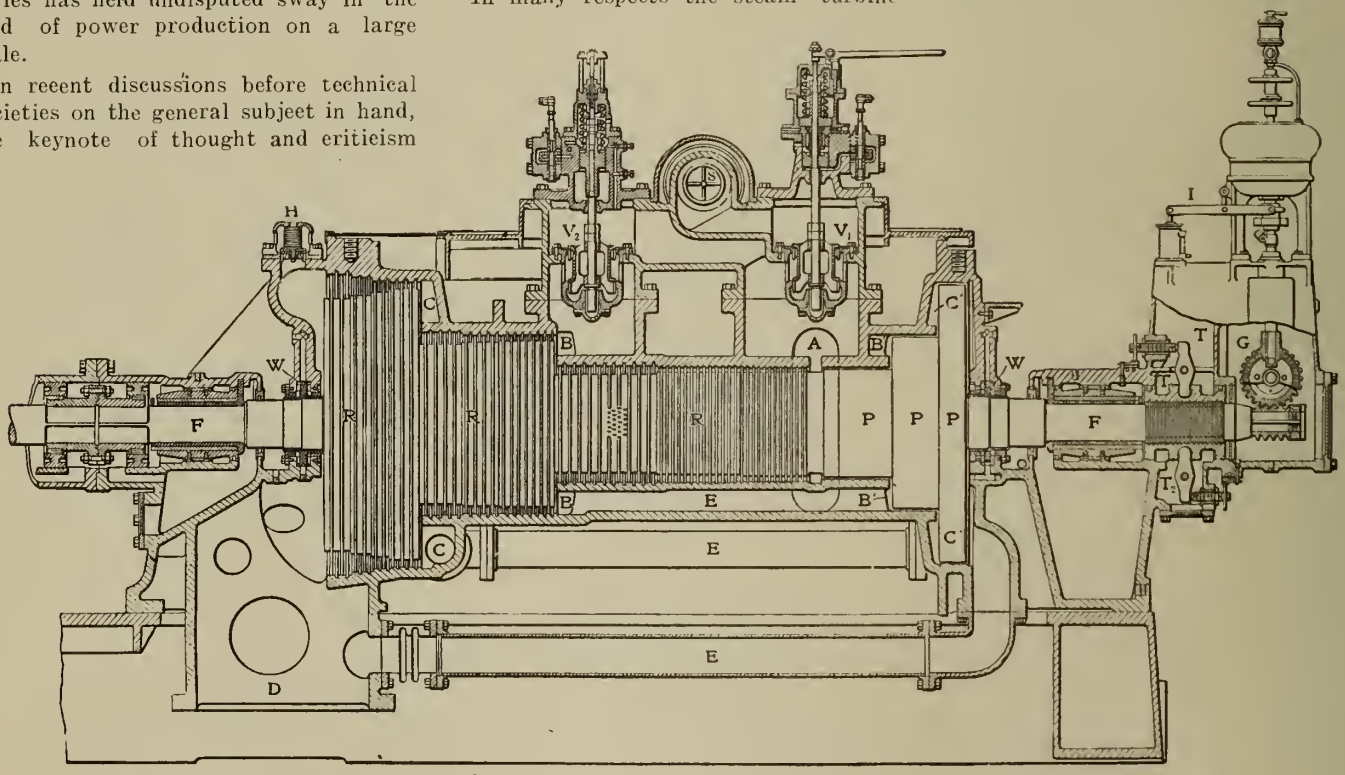



Fig. 1.—Westinghouse-Parsons Single Flow Turbine.

* All prime movers which operate on the principle of the conversion of kinetic energy of a fluid jet directly into rotation, either by impact or reaction, or by both, may be broadly classed as turbines.

** This point may be brought out by the following comparison: One pound of steam discharging through a nozzle from 165 pounds pressure to 1 pound absolute, or 28 inches vacuum, will, theoretically, develop about 250,000 foot pounds of energy. One pound of water on the other hand, will develop but 379 foot pounds under the same conditions. The velocity of efflux of the water jet will be about 156 feet per second, and that of the steam jet over 4,900 feet per second, or 50 miles per minute.

The general principles of design of the hydraulic turbine apply to the steam turbine as well. Thus all surfaces coming in contact with the working fluid should be so designed as to minimize surface friction and avoid eddy currents. The jet should be so guided as to meet the vanes without shock and no sharp angular deflections should occur during its change of direction. In the impulse turbine, of which the Pelton and DeLaval are representative, the proper velocity of vanes for maximum efficiency should be half that of the issuing jet. In the reaction type it should be equal to that of the deflected jet. Thus, in the DeLaval steam turbine, the bucket speed should be about 2,000 feet per second for best efficiency under high vacuum. This enormous speed, however, imposes such severe stresses in the metal of the disc that in practice lower speeds are, of necessity, employed.*

To the Swedish engineer, DeLaval, belongs the credit of introducing the ingenious divergent nozzle as a means of obtaining full expansion of steam in suitable form for projecting against a rotating vane wheel.

As the increasing diameter of the nozzle provides room for further expansion, the jet velocity increases and the pressure and temperature fall through the entire range from boiler to condenser. This occurs within a length of a few inches. The expansion is nearly adiabatic and the temperature at each section of the nozzle remains approximately constant.

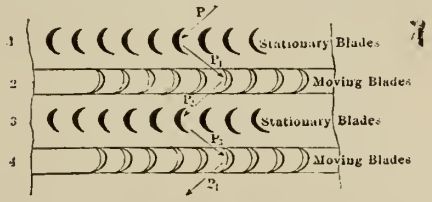



Fig. 2.—Blades of Westinghouse-Parsons Turbine.

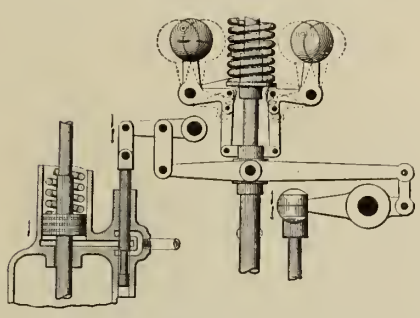


Fig. 3.—Diagrammatic Arrangement of Governor Mechanism.

All turbines make use of this principle in one form or another. The DeLaval construction still retains the high disc speed, which ranges from 10,000 to 30,000 r.p.m., depending upon the size. This necessitates a 10 to 1 reduction gear. Parsons, however, from the very first aimed at speeds sufficiently low to provide for direct connection of the turbine to generating and other machinery without the use of gearing. This result he secured through the use of the multiple expansion, or stage principle, an invention fully as remarkable in its effect upon the industry as the brilliant inventions of the divergent nozzle and flexible shaft by DeLaval. He instituted the arrangement of vanes shown in Fig. 2 which replaces the expanding nozzle.

This leads to an extension of the process ad infinitum, resulting in a fractional abstraction of energy, pressure, and velocity by a number of vane wheels mounted in series upon a single shaft. This principle distinguishes the Parsons or parallel flow turbine from the simple impulse type, and secures commercial

* In a 30 h.p. turbine which operates at a speed of 20,000 r.p.m. the radial stresses at the rim amount to 23,000 pounds per square inch.

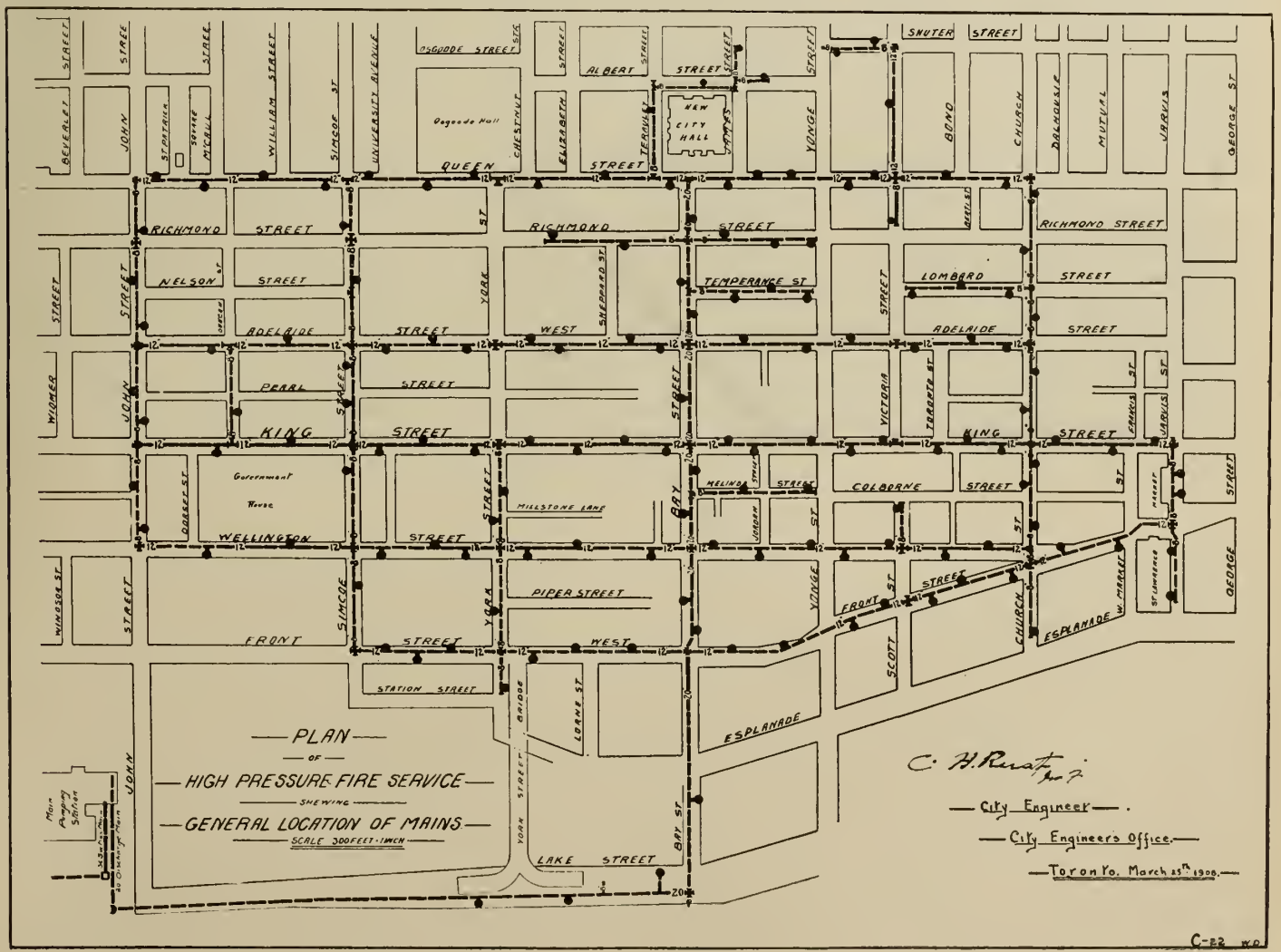



Fig. 4.—Plan of High Pressure Fire Service System in Toronto's Business District Showing Location of Mains.

speeds of rotation without the use of reduction gearing. No nozzles are employed, as the functions of the nozzles are performed by the vanes themselves.

### Construction.

Turning now to the general construction of the Westinghouse-Parsons turbine, a section of which is shown in Fig. 1, we observe three essential elements : the rotor, the stator, and the balancing pistons. The rotor consists of a cylinder of three or more drums of increasing diameter, upon the periphery of each of which are mounted numerous rings of radial vanes. The stator comprises a split casing of interior proportions conforming to those of the rotating cylinder. The interior walls of the casing are studded with rows of stationary radial blades corresponding to those on the moving cylinder but assembled with a reverse pitch.

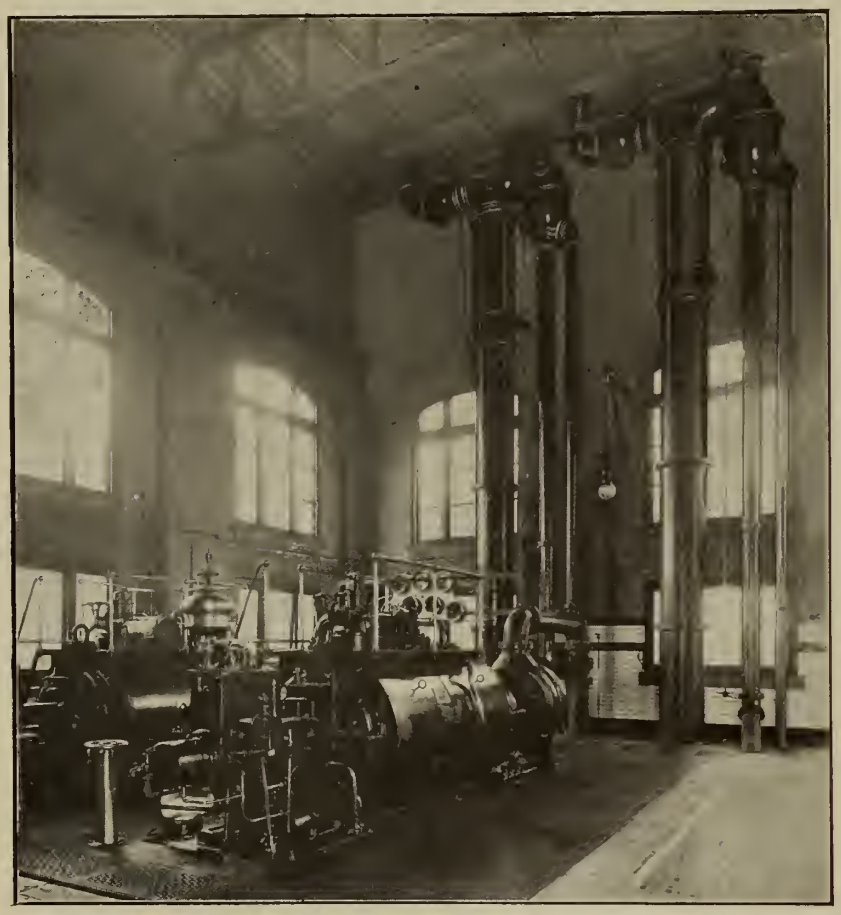


Fig. 5.—View of High Pressure Pumping Station, Toronto, Showing Westinghouse-Parsons Steam Turbine and Barometric Condensers.

The steam volume progressively increases from inlet A to exhaust B in the annular space between the rotating spindle and the cylinder walls. The entire expansion, which is approximately adiabatic,* is carried out within this annular compartment which essentially resembles a simple divergent steam nozzle. There is this difference, however, that whereas in a nozzle the heat energy of the working steam is expended upon itself in producing high velocities of efflux, in the Westinghouse-Parsons turbine the total energy, due to expansion between pressure extremes, is subdivided into a number of steps. In each step the dynamic relationship of jet and vane is such as to secure a comparatively low average velocity from inlet to exhaust, this generally varying from 150 feet per second as a minimum at the high pressure end to about 600 feet per second as a maximum at the low pressure end.

The result is of the utmost importance. With high steam velocities, excessive surface speeds are encountered, causing serious losses from fluid friction and rapid deterioration of parts from erosion. With low steam velocities, commercial speeds are readily obtained, friction loss is greatly reduced, and the depreciation of the turbine from practically the only source of wear becomes inappreciable.

The expansion of steam at any one element is typical of its working throughout the turbine. Each element consists of a ring of stationary and a ring of moving blades. The former give direction and velocity to the steam ; while the latter immediately convert the energy of velocity into useful torque. The total torque upon the shaft is due both to impulse of steam entering the moving blades and to reaction as it leaves them.

A condensing steam turbine in operation affords a striking example of the conversion of heat into work. The temperature of the cylinder falls, within a distance of three or four feet, from 365 degrees Fahrenheit at the high pressure end to 115 degrees at the exhaust end, when working with 150 pounds steam pressure and 27 inches vacuum. These temperatures remain constant during operation. There is no alternate condensation and re-evaporation as in the piston engine.

### The Vanes.

The most vital parts of the turbine are the steam vanes or blades, as upon their precise curvature and arrangement depends in a large measure the economy of the machine. The form of blade used in the Westinghouse-Parsons turbine is the result of both theory and extensive experiment. They are usually made of a special bronze, cold drawn, of tensile strength averaging 75,000 to 80,000 pounds per square inch with 20 per cent. to 30 per cent. elongation. This material is drawn out into long strips and the blades are then sawed off to proper lengths. They are assembled by a caulking process in grooves turned in the steam surfaces of rotor and stator. This method has proven so effective that the force required to pull out the blades exceeds the elastic limit of the material. It also greatly facilitates repairs, should such ever prove necessary. In direct contrast to this simple form of blade-mount is that employing milled buckets on the periphery of the turbine wheels. Accidents are of course unavoidable in the most perfect mechanisms, but should such occur in the Parsons form of turbine, the damage is generally quite local, a few rows of blades only being affected.

### Governor.

The method of regulating the speed of the turbine comprises two unique features ; one in mechanism, the other in theory. Fig. 3 shows diagrammatically the arrangement of the governor mechanism. The governor is of the purely centrifugal type with bell crank levers swung on knife edges and resisted by a spiral spring, the pressure of which may be adjusted by the knurled tension nut. The spring part of the mechanism is mounted between ball bearings and may be brought to rest while the turbine is running. By increasing the spring tension the speed of the turbine is increased, and vice versa. This affords a means of synchronizing two alternating

* No heat is taken in or given out by the steam cycle.

current generators for parallel operation and for accurately distributing the load after synchronizing. The main admission valve is actuated by an auxiliary piston B, which is in turn moved by the pilot valve A through the agency of high pressure steam admitted through the ports shown. D and E are fixed points, F a floating fulcrum, the position of which is determined by the position of the governor balls. Reciprocating motion from an eccentric driven by a shaft is transmitted to the point C. This reciprocating motion is transmitted to valve A and finally to the main admission valve. High pressure steam is thus admitted to the turbine in short puffs, with the frequency of about 150 strokes per minute. The function of the governor is to vary the plane of oscillation of the pilot valve A, thus varying the period of steam admission to the turbine in proportion to the load. "A" also operates as a safety stop ; a large movement either way from mid-position results in shutting off steam to the admission valve. Thus the turbine will come to rest should a heavy short circuit occur or the governor mechanism break.

With speeds as high as 3600 r.p.m , it becomes necessary to provide flexibility to absorb vibrations occurring while the turbine is passing its critical speed. The bearing used in turbines under 1000 k.w. capacity consists of a nest of loosely fitted metalic sleeves surrounding the shaft and resting in a self-aligning seat in the pedestal. Oil circulates between the sleeves and by capillary action fluid cushions are formed which restrain vibration and at the same time give sufficient flexibility to allow the shaft to revolve about its gravity instead of its geometric axis. The shaft is, therefore, built as rigidly as desirable, and the crystallization experienced in turbines employing flexible shafts is avoided. In turbines above 1000 k.w. capacity, a solid split self-aligning journal is used, as the speeds are so low as not to require the flexible journal. All bearing surfaces are sufficient to render forced lubrication unnecessary, as usually understood to mean, oil under high pressure ; i.e. pressure of several hundred pounds per square inch ; and as the weight of the shaft is carried by oil films, practically no wear is experienced. This is evident from the fact that after several years operation, a turbine bearing, after the dismantling of the machine, showed the original tool marks upon the inner shell.

In furnishing the oil supply for the turbine bearings, a small plunger pump, driven by the turbine itself, is employed. It circulates oil through a closed system comprising in the order of their arrangement : pump, oil cooler, bearings, and reservoirs. The pressure impressed upon the oil films at the bearings is equivalent to a static head of one to three feet, no oil under high pressure being used in the turbine. It is hardly necessary to emphasize the utter simplicity of this system of lubrication and the soundness of engineering judgment behind it which avoids the hazard incident to high pressure oiling systems in the hands of careless or incompetent operators.

### Toronto Instalation.

Toronto, a few years ago, suffered an enormous loss by fire, and on investigation found that the fire engine alone did not solve the question of fire protection. Fig. 4 shows the district covered by Toronto's high pressure pumping system.

The plant for pumping the water consists of two pumping units, each unit having a capacity of five million gallons per day of 24 hours, against a total head of 300 lbs. per sq. in. on the discharge main at the pumps. Each unit consists of a Westinghouse-Parsons steam turbine direct connected to a two-stage centrifugal pump. Steam is supplied to the turbines at 150 lbs. pressure. They operate with barometric condensers shown in Fig. 5, under 27 ins. of vacuum. The pumps are two-stage and operate at 300 lbs. per sq. inch, or 150 lbs., as desired, when running at 1500 r.p.m.

Fig. 6 is a view of the high pressure pumping plant showing the Worthington two-stage pumps in the foreground. Fig. 7 is an elevation of the high pressure pumping plant showing arrangement of turbines and pumps. The turbines and pumps are mounted upon con-

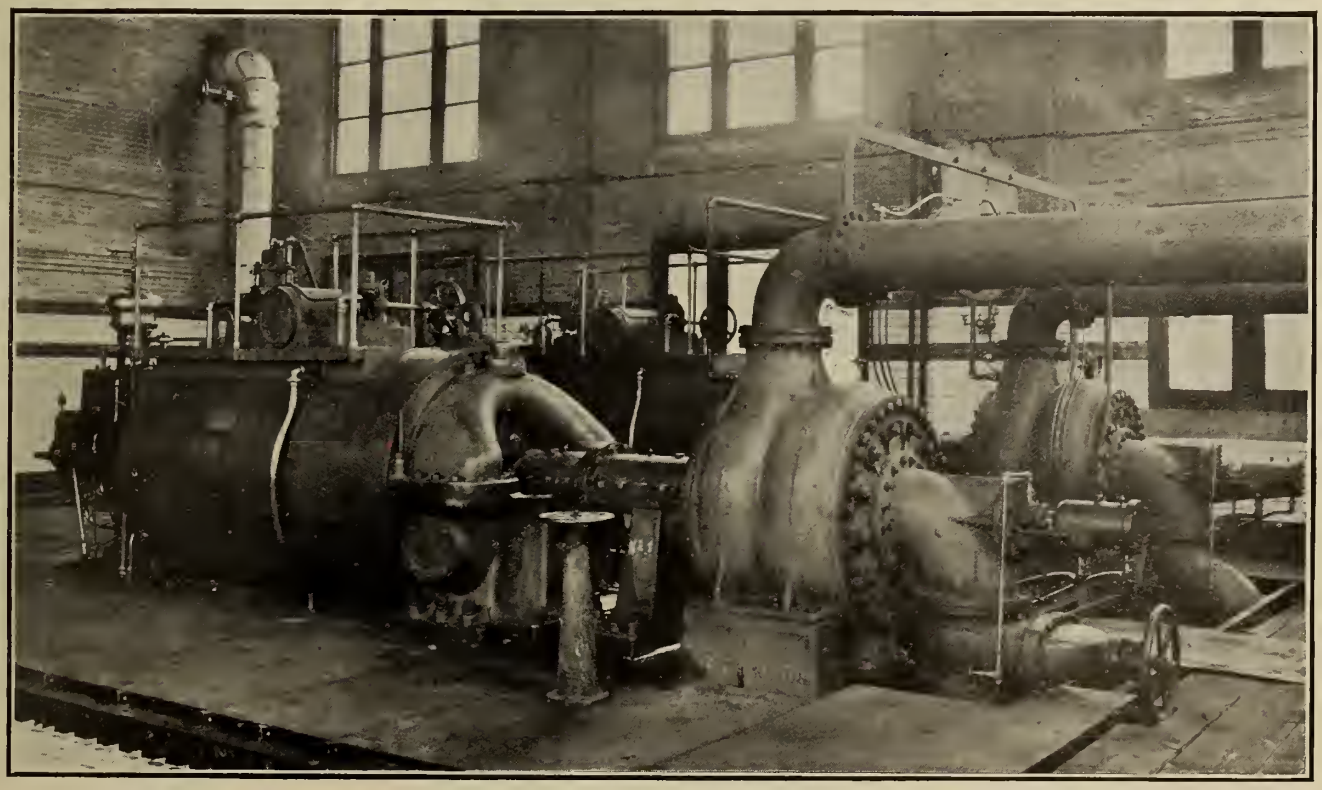


Fig. 6.—High Pressure Pumping Plant, Toronto. Showing Worthington Two-Stage Pumps in Foreground.

tinuous bedplates provided with necessary supports for bearings. The turbines have a guaranteed overload capacity of 25 per cent. They can be disconnected from the pumps and both turbines and pumps may be inspected without materially disturbing the arrangement of the combined set.

The specifications called for jet condensers with each unit, and that 26 ins. vacuum should be maintained. The jet condensers were removed after they had been installed, and the barometric condensers, shown in Fig. 5, were installed. It is claimed by the Toronto Waterworks Department that the barometric condensers are better suited to the work where flexibility is required.

The main castings for the pumps are of cast steel. Each stage of the pumps is provided with pet cocks at the highest point, so as to insure them being free from air before starting. The guide vanes in the pumps are entirely separate from the main casting so as to be readily replaced. The driving vanes are held in place on the bronze driving shaft by feather keys. The bearings are ring oiled and babbit lined.

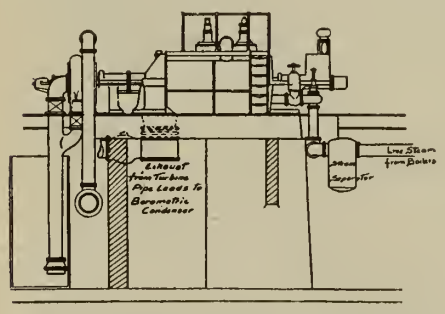


Fig. 7.—Elevation of High Pressure Pumping Plant Showing Arrangement of Turbines and Pumps.

The street hydrants are provided with three nozzles, a reference to Fig. 4 will show their number and position. They are designed so that the pressure of the water in the main will tend to close the main valve. Bronze is used in the construction wherever there is danger of corrosion. The outlets in the hydrants are all controlled by independent valves. Each of the outlets are 3½ inch standard. Hydrants are protected from the action of the frost by means of a frost jacket, constructed of cast iron.

The contract for the two turbine driven pumps, including steam turbines, pumps and condensing apparatus, was by the Canadian Westinghouse, Hamilton. The turbines were built by the Westinghouse Machine Co., and the pumps and condensing apparatus by the John McDougall Caledonia Iron Works Co., Montreal. The valves were supplied by the Canada Foundry and hydrants by A. P. Smith, Newark.

# American Boiler Manufacturers' Association

## Some Important Discussions at the Annual Meeting of the A.B.M.A. at Detroit, Mich., August 10, 11, 12—Cause of Boiler Explosions. etc.

Several questions of general interest to both United States and Canada were discussed: "What is the best method of keeping water in circulation in corrugated furnace boilers?" "In return tubular boilers made in more than one sheet, which is the best practice, to make the lower half in one sheet or have a girth seam, this being clear of the direct action of the fire?"

In connection with the first question, J. J. Main, of Polson Iron Works, Toronto, described a device consisting of a shaft let into the front end of the boiler, running through to the back end, with miter gears on the shafting and a vertical shaft from that extended downward near the bottom of the boiler, with a small propeller wheel placed on it about 10 in. in diameter, and a small crank on the shaft on the front end, making it possible to be operated by the fireman during the early stages of raising steam. These propellers agitate the water and create a circulation before the steam is raised. Being asked how he fed the boilers, Mr. Main replied that it was fed in the top, a pipe being turned down into the bottom of the boiler, then a nozzle turned up; the pipe is run down past the combustion chamber along the bottom and then turned up.

### Discussion of Question 2.

John J. Main said that he built boilers with the girth seam clear of the bridge wall, probably due to the fact that he was unable to obtain plates large enough to make the boilers in one sheet, as the rolls were not long enough to produce the latter. Mr. Wangler, St. Louis, thought it the better practice to employ a girth seam.

### Heating Rivets.

An interesting discussion of some length followed on the merits of heating rivets by oil or otherwise.

C. J. Wangler, St. Louis, reported having had trouble with leaking rivets using oil furnace and had gone back to coal. Though it may be possible that the oil furnace may be so regulated as not to give trouble, yet with the class of men obtainable in many instances the regulating of the heat is more difficult to secure, and coal is preferable on this account.

Mr. Wangler stated that a certain scale was formed by this process in practice that gets into the die and cuts it to pieces; it seems to stay on the rivet and does not work out. The scale also gets into the crevice between the rivet and the sheet and prevents tight contact.

Mr. Hartley stated that scale might be produced on rivets from many causes. It often occurs by having too many rivets in the furnace at one time. Scale generally forms when the furnace is idle waiting for rivets to be called for. If the temperature falls in the furnace scale forms immediately. For hydraulic machine work rivets should not be heated above a good bright red heat. He said that too much attention cannot be paid to the mode of heating, and also to the removing of the burr off the edge of the rivet holes. The burr holds the sheets apart and will allow some of the rivets to flow into the burr space. If water once gets under the rivet head it is apt to come through on the sheet. No imperfect rivets should be used under any circumstances. The removal of the burr described makes a perfect stop-water. Most specifications now prohibit calking, and in Germany they are very strict in this regard.

M. A. Ryan, Duluth, Minn., has for the past two years employed an air drill for removing burrs after the work has been drilled and then taken apart for this purpose. Since adopting this method he has materially reduced the percentage of leaking rivets. The Hartford specifications call for this work to be done, but at least 75 per cent. of the boiler manufacturers do not do it, but leave the butt straps on instead of taking them off and removing the burrs. In circular sheets especially the greatest necessity exists for taking this precaution. Put both heads in and countersink all holes and all trouble will be avoided. Holes of, say, 13-16 in. originally can be reamed to 15-16 in.

John J. Main thought that it was more a question of temperature than kind of fuel; at a certain temperature the rivet is more apt to absorb the sulphur and form scale. When scale does form, notwithstanding all precautions, the rivet may be dipped in a pail of water, and then the scale will drop off, or the rivet can be thrown aside and the scale knocked off at some convenient time. If rivets are heated too hot and driven too fast and put in hot they will afterward contract in the hole and become loose.

In the course of a discussion of the quality of steel plates President E. D. Meier, who is also president of the Heine Safety Boiler Co., St. Louis, said that in the course of an investigation of boiler casualties, which he had

made some years ago, based on reports of boiler explosions given in a publication issued by the Hartford Steam Boiler Inspection & Insurance Co., he had divided them into groups according to causes of explosions and also as to localities. To his amazement he had found that the explosions in country districts far exceeded those in cities, the rate being 40 to 1, and this was the case even before the present days of inspection ordinances in cities. He also found that as a rule the character of the steel had very little to do with the cause of the explosions, although, of course, if the sheet was defective there would always be present danger of explosion from that cause. The trouble was due more to the want of competent men to handle the boilers. As to bad calking, he remembered only one instance, that of the Acushnet explosion, and a study of that had convinced him that the trouble was even there due more to another cause—namely, that the sheets had not been properly laid on each other. Most of such matters, he said, can be met by proper inspection.

## WINNEPEG POWER PLANT.

The new Grain Exchange building has, perhaps, the best equipped power plant of any building in the city. The plant was installed last fall from the most modern supply houses on the continent. The only A.C. alternating current generator to be found in Winnipeg are in service in this building. There are two engines of this class made by Robb-Armstrong Engine Co. One 15x14 engine is fitted to an 80 k.w. generator, the other engine 13x14 is attached to a 60 k.w. generator. The generators are made by Allis-Chalmers-Bullock Co., who have a branch here. The elevators are run by two massive Fairbanks-Morse pumps, duplicate set and compounded. The building is heated by three Babcock-Wilcox boilers, 150 h.p. each, and fitted with automatic stokers. A splendid section of the plant is the ventilation system. This matter is too infrequently neglected in other modern buildings. The air is drawn in, washed and distributed to all the offices in the building, about fifty in number. Two sewerage injector pumps manufactured by the Shone Engineering Co., of Chicago, and installed by Cottor Bros. of Winnipeg, are in operation here. The maximum pressure of the injectors is 14 pounds, maintained automatically, and run by two 2 h.p. motors. The building is lighted throughout by the Nernst Electric Lamp, supplied by the Westinghouse Co. These are the first Nernst lamps that have been used here.

## EXHIBITS AT TORONTO EXHIBITION.

There was a good display of power machinery, equipment and transmission supplies at the Canadian National Exhibition, held in Toronto August 28 to September 13. The following are a number of the exhibits:

### Machinery Hall.

R. H. Buchanan, Montreal—Power supplies.

Chapman Double Ball Bearing Co., Toronto. This is a very interesting exhibit, a linen thread driving a countershaft with three pulleys, and a motor wheel is driven from one of these pulleys by friction. In the Transportation Building the application of the bearings to various vehicles is shown.

Canada Metal Co., Toronto—Babbit and metals.

Canada Steam Boiler & Equipment Co., Toronto.—Improved Cyclone grates, vacuum valves and Standard Crown valves, manufactured by the Standard Engineering Co., Toronto.

Philip Carey Mfg. Co., Toronto—Pipe insulation materials.

Crescent Oil Co., Hamilton—Lubricating oils.

Dominion Belting Co., Hamilton—Maple Leaf and stitched cotton belting.

Dymond Gas & Engine Co., Toronto—Weber gas engine and Dymond producer.

Ferranti Co., Hollinwood, Eng.—Ferranti meters, represented by George C. Royce, Toronto.

Dodge Mfg. Co., Toronto—Fine display of their well-known pulleys.

Goold, Shapley & Muir, Brantford—Gas engines.

Gilson Mfg. Co., Guelph—Air-cooled cylinder gas engines.

Kellogg & Co., Toronto—Gas engines.

E. Long Mfg. Co., Orillia, Ont.—Water turbines.

Lunkenheimer Co.—Steam fittings of all kinds, including valves, whistles, oil cups, force feeds, etc.

D. K. McLaren, Montreal and Toronto—Oak-tanned leather and waterproof cement.

Exhibit of Ferranti Limited in Machinery Hall, at the Canadian National Exhibition at Toronto. G. C. Royce, 22 Dundas St. West, Toronto, is the Canadian representative and is in charge of the exhibit. The exhibit includes Ferranti watt meters, prepay meters, motor starters and switchboard appliances, oil switches, circuit breakers, relays, etc. A feature of the exhibit is a special D.C. meter with disc revolving in mercury, the properties of which are accuracy and durability. Several thousand Ferranti meters are already installed in Canada, and many steamships including the Mauritania, are equipped with Ferranti apparatus.

Smart-Turner Machine Co., Hamilton—Boiler feed pumps and pumps for heating systems.

I. E. Shantz & Co., Berlin and Toronto—Diamond grate bars.

Waterous Engine Works, Brantford—Road roller and boilers.

Dudbridge Iron Works, Stroud, England—An exhibit of oil engines.

Fitz Water Wheel Co., Hanover, Pa., were introducing Fitz water wheels to visitors at the Exhibition.

Garlock Packing Co., Toronto—Garlock packing for steam engines, air compressors, etc.

Jones & Moore Electrical Co., Toronto—Electrical equipment, motors, etc.

Robertson & MacGavin, Toronto—Steam specialties and engineers' supplies.

**Industrial Building.**

Butterworth Foundry Co., Ottawa. In addition to other products of their works, such as stoves, etc., they exhibited Fleming grate bars.

Electrical Specialties, Ltd., Toronto—Batteries in all sizes and electrical supplies.

J. A. & W. Bird & Co., Boston—Cotton belting, represented by T. R. Flint, Toronto.

S. F. Bowser & Co., Toronto—Oil storage tanks.

Canadian Westinghouse Co., Hamilton—Small motors, Nernst lamps and electrical fixtures.

James Morrison Brass Mfg. Co., Toronto—An attractive exhibit of brass goods, such as steam specialties, brass fixtures, steam gauges, electric light fixtures, etc.

H. W. Johns Manville Canadian Co., Toronto—A fine display of all kinds of insulating materials for steam pipes, packings, etc.

Northern Electric & Mfg. Co., Montreal and Toronto—Motors, electrical fixtures, factory telephones for interfactory communication, etc.

Tallman Brass & Metal Co., Hamilton—Metals and babbits, including Arctic metal.

Northern Aluminum Co., Toronto—Aluminum manufactured goods, including cable, etc.

**Manufacturers' Building.**

Canada Rubber Co., Montreal—Mechanical rubber goods, etc.

Dunlop Tire & Rubber Goods Co., Toronto—Mechanical rubber goods, etc.

Gutta Percha & Rubber Mfg. Co., Toronto—Mechanical rubber goods, etc.

# Compressed Air and Vacuum Cleaning System

## The Toronto Street Railway Use the McCabe Combined System with Great Success—Description and Tests of the Compressor and Equipment

In the McCabe system, in permanent instalations, compressed air is laid on by a suitable compressor in a convenient place in the building with piping, usually consisting of one small pipe usually ¾ in. running from compressor tank to top storey and dust discharge pipe running similarly from top floor to basement, with suitable valves at each floor, or where there is no portable plant, air is obtained from a portable apparatus and led by a pipe to the room or article to be cleaned.

The vacuum apparatus is then attached. The essentials of this apparatus are roughly a short pipe in which a nozzle is fixed so that it points (parallel with the pipe) toward one end, known as the discharge end, and the nozzle is then connected with the compressed air pipe. The compressed air discharging out of the nozzle into the pipe drives the air in the pipe towards the discharge end, creating a vacuum at the inlet or vacuum end, thus causing a current of air to move at a high velocity in at the inlet past the compressed air nozzle and out at the discharge. The pipe and compressed air nozzle are specially designed to give this result, and this pair is usually known as the vacuum machine. Its closing weight is about sixteen pounds. By closing the discharge end and coupling the proper nozzle to the inlet end, the operation is reversed and air is blown out under 60 pounds pressure, thus giving the compressed air feature of the system. For portable use the air compressor is mounted on a suitable carriage and the compressed air pipe can then be led to any point several hundreds of feet away (¾ in. pipe sufficient) and the vacuum machine or compressed air nozzle attached.

**Record of Tests.**

The following is a record of air compressor tests made on June 25th by Mr. McRae and Mr. McCabe, of the Toronto Street Railway Co., assisted by Mr. Reavell and Mr. Vandeleur, representing the makers of the compressor. The following gentlemen were present: C. H. Sweetlove, foreman electrical department; Chas. Deacon, foreman machine department; H. McCarthy, assistant inspector of compressors.

**Description.**

The compressor is one of Reavell's single-stage, water-jacketed type, designed to deliver 60 cubic feet of free air per minute and for a working pressure up to 100 lbs. per square inch. It is driven through rawhide gearing by a Laurence Scott motor, coupled on the same bed plate. The compressor is installed on a wagon, arranged to run on the street railway system, and the wagon is also fitted with necessary electrical equipment and an air receiver piped up to the compressor.

The motor was designed to run on 500 volts, giving a compressor speed of 300 r.p.m. At the car barn where the test was made, however, the voltage was 600, instead of 500, thus increasing the speed of the compressor and also its capacity. Three tests were made, the first to determine the speed of the compressor in the increased voltage; the second to determine the mechanical efficiency, and the third to determine the volumetric efficiency.

**Test 1.**

The compressor was run on the line voltage of 600 volts, and the speed of the motor taken. This was found to be 930 r.p.m. The designed speed of the motor at 500 volts was 850 r.p.m. The normal speed of the compressor being 300 r.p.m., its actual speed during the time of the test was:

$$\frac{300 \times 930}{850} = 328 \text{ r.p.m.}$$

It is now required to find what the capacity of the compressor would be under these conditions. The piston displacement capacity of the machine at its normal speed is 66 cubic feet per minute. The increased capacity, due to the increased speed, will then be

$$\frac{66 \times 328}{300} = 72 \text{ cu. ft. displacement.}$$

**Test 2.**

A test was made now to ascertain the mechanical efficiency of the system. The compressor was run with the air blowing off at 80 lbs. pressure, when the electrical readings were as follows:

Voltage, 600
Amperes, 17
Resulting kilowatts, 10.2
} Resulting electrical h.p., 13.7.

The electrical input into the motor was, therefore, 13.7.

It is now required to determine the work done in horse power in compressing the air. The following formula was used:

$$\frac{C \times 144 \times P}{33000} = \text{H.P.}$$

In this formula "C" signifies the displacement capacity of the compressor in cubic feet per minute, i.e., 72. "144" signifies the number of square inches in a square foot. "P" equals the mean effective pressure against the piston of the machine. This could not readily be obtained by indicator diagrams and consequently the average figure assumed by makers of standard compressors for the mean effective pressure due to 80 lbs. delivery pressure was taken. For authority see Hiseox's book on "Compressed Air," page 142, table 18. The mean effective pressure there taken is that based on the pressure being able to absorb four-tenths of the heat of

compression, which is the average figure obtained in straight line machines. This means effective pressure for 80 lbs., working pressure is 37.28 lbs. The formula, therefore, appears as follows:

$$\frac{72\times144\times37.28}{33000}=11.7 \text{ indicated h.p}$$

The test, therefore, showed that with an input in electrical energy of 13.7 h.p., the compressor was actually giving an indicated horse-power of 11.7 in the air which it delivered. The efficiency, therefore, would be,

$$\frac{11.7\times100}{13.7}=85.5 \text{ per cent.}$$

In other words, the only losses in the machine were 14½ per cent., representing the combined losses of the motor, the gearing and the mechanical losses in the compressor. The rest of the energy put into the machine appeared as indicated horse-power on the air delivered.

**Test 3.**

This test was directed to finally determine the volumetric efficiency of the compressor. The air receiver of the truck was two feet internal diameter by six feet long, its cubic capacity, therefore, would be 3.1416×6=18.8496, or say, 18.85 cubic feet.

The equivalent free air capacity to fill that air receiver at 90 lbs. pressure would be,

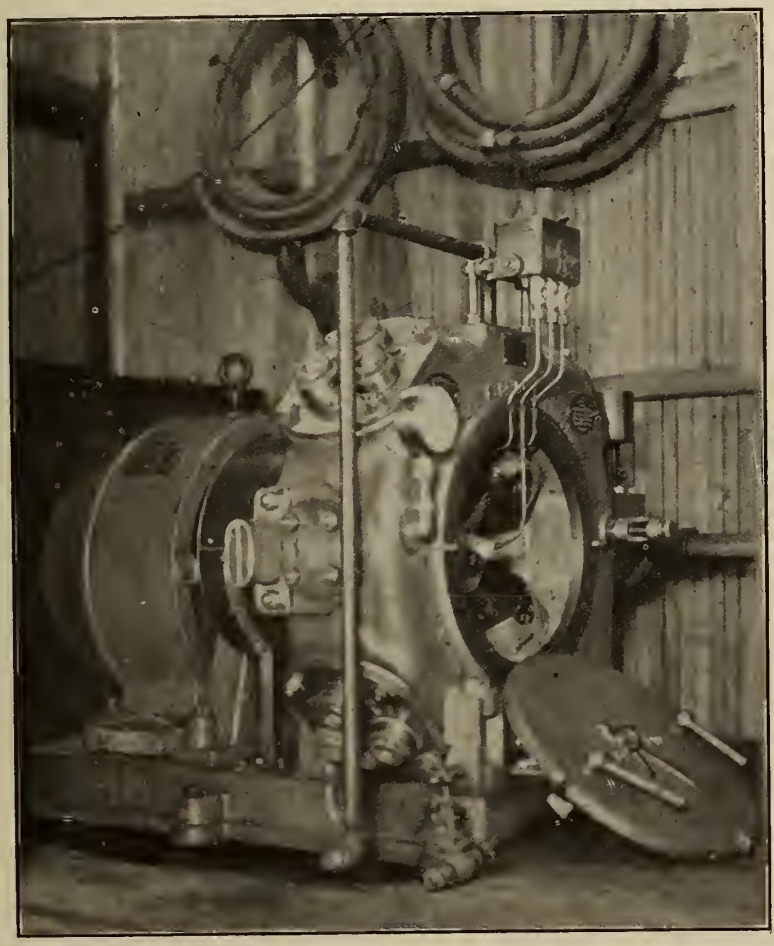
$$\frac{18.85\times80}{15}=100 \text{ cubic feet.}$$

As the compressor at its full speed was 72 cubic feet, the time required, assuming 100 per cent. efficiency, would be one minute 24 seconds to fill the receiver. A test was taken to fill the air receiver from atmospheric pressure at 80 lbs. per square inch, and to ascertain the time actually required. The time was taken when at the instant the motor was started and it was found that the machine took exactly one minute twenty-six seconds to fill the receiver, to a gauge of 80 lbs. per square inch.

The volumetric efficiency, therefore, was represented by the ratio of 84.86, or expressed in percentage would be,

$$\frac{100\times84}{86}=97\frac{1}{2} \text{ per cent.}$$

The water jacketing of the compressor was most efficient, as the air leaving the compressor to enter the receiver was just a comfortable temperature to the hand, as far as could be judged by the delivery pipe; no thermometer temperature, however, could be taken.



Motor and Air Compressor Set for Cleaning Cars—Toronto Street Railway.

## THREE-WIRE D. C. GENERATORS.

When the load on the central station generators consists of both motors and incandescent lamps, as is often the case in small isolated plants, it is found advantageous to use what is known as the three wire system. The motors may be connected to the outside wires at a voltage of 220 while the lamps may be operated at 110 volts being connected between the neutral and the outside wires. This arrangement is especially advised when the motors are of the variable speed type since the three wire system offers an excellent arrangement for a 2-voltage variable speed control.

The general design and appearance of the Western Electric three-wire generator differs little from the standard "L" design generator. The most distinct features in the design of these machine is a doubly wound armature which is employed for obtaining the neutral e.m.f. point. Use is made of a special balancing winding which is placed beneath the usual armature winding at the bottom of the slots. This winding is interconnected with the main armature and with a slip ring in such a way that the slip ring always possesses a potential midway between the potentials of the two brushes. The section of the copper in the auxiliary winding is large, so that the current density is low, thereby enabling the machine to take care of very large unbalanced loads. The voltage regulation is close even under sudden or large changes in the unbalanced loads.

In order to compound for the total load on the generator under all conditions, the series field winding is divided into two parts, one-half of the coils being connected to one terminal of the armature and the other half to the other terminal; the coils on alternating poles being connected to the same side of the armature. The liability of the breaking down of the insulation is reduced to a minimum, since the coils having the full potential of the machine between them are not placed on the same pole. This arrangement further results in perfectly balanced magnetic and electric circuits. The neutral wire is connected to the brushes, which rest on the collector rings, electrically insulated from, but mounted at the end of the commutator. This simple construction is possible because no shifting of the neutral brushes is required no matter what amount of overload is carried.

## BEST PAPER IN THE DOMINION.

Editor of The Power House,—

I feel very thankful for reply to an article in The Power House in reference to coal oil in boilers. You deserve credit in the prompt way you conduct your answers to correspondence. It will make The Power House the best paper in the Dominion.

EDWARD THOMAS.

# Large Electric Power Development in Newfoundland

Large Hydro-Electric Undertaking at Grand Falls on the Exploits River—Modern Scheme Followed—Description of Equipment.

By ALFRED BRIAN

One of the greatest developments in Eastern America at the present time is under way at Grand Falls, Newfoundland, where the Anglo-Newfoundland Development Co., Ltd., are building a mammoth paper mill. This company has secured extensive areas of valuable timber land, as well as mineral-bearing territory from the government, and are spending millions of dollars at the present time, and will spend millions of dollars more in the future, in developing their property. They have dammed the Exploits River at Grand Falls, a quarter of a mile above the falls. The total length of the dam is 2,000 feet, while water flows over a part 900 feet long. Part of this is shown in one of the photographs. The dam is 20 feet high.

The Exploits River has its source from the Red Indian Lake, into which numerous other lakes have their outlet. Among these are the Victoria, Lloyd, King George IV., Rogerson, and other smaller lakes. These are situated among the Annieopsquolch Mountains, so that there is no danger of a scarcity of water. This summer was an exceptionally dry one, and the water was lower in the rivers than at any time before noted. However, at this very low water-mark, they figured that they had over 40,000 horse power. At a normal flow of water they would have over 60,000 h.p.

Two large steel flumes, 15 feet in diameter, leave the dam, and are carried down half a mile to the power house. These flumes are built in segments made of steel plate, manufactured on the ground in the company's own boiler shop. This boiler shop is fully equipped with modern machinery, and at present a steam engine furnishes power. However, the construction of the building is not yet completed. The flume is laid on the solid rock bottom, and they have blasted out the rock in order to get the flumes down beneath the surface. A small section of the flumes under construction is shown in a photograph herewith. A little below the falls are some rapids, which are very picturesque. These are also shown in a photograph. The power house is placed near the river below these rapids. The intervening falls are 60 feet high, so that from the dam to the power house, below the rapids, there is a drop of about 120 feet. Before reaching the power house, one of the flumes branches off into two parts.

The water turbines are three in number, and are of Swiss make. They are designed so that they will give a minimum of 10,000 h.p., but at higher water they can give nearly twice that amount of power. Each turbine is furnished with a large gate, in order to regulate the supply of water. The generators are of the Westinghouse make, and are of the vertical type, directly connected to the turbines.

The main building is situated about four hundred yards from the power house. There are over a dozen buildings comprising the plant, and all of these, including the power house, are built of re-inforced concrete. The buildings when completed will cover more than twenty-five acres of land. At present, there are 15 contractors' hoists, of the Mead-Roberts manufacture, and two large Allis-Chalmers-Gates crushers being used on the construction work.

The mill machinery will all be driven by electric power, and for this purpose seventy-five motors have already been purchased from the Westinghouse people, the largest of which is 300 h.p. They will manufacture finished paper of all qualities, from the coarsest wrapping to the finest writing paper.

There are about six miles of track about the plant, including a mile from the works connecting to the Reid-Newfoundland Railway. It is proposed to open a line of railway from the company's plant, taking a short cut to Placentia Harbor, a distance of about 90 miles. This will give them a convenient port for their output. The road would be a narrow gauge steam railway, but as yet, it is not definitely decided upon, and for a while, at any rate, they will use the Reid-Newfoundland system for shipping. Small vessels can come up the Exploits River to Grand Falls, and they have brought in much of their construction material in this way.

Two years ago, there was not a house in Grand Falls, but to-day, there are 1,200 people, and the little town is growing very rapidly, it having a great future before it. The Anglo-Newfoundland Development Co., Ltd., have undertaken to build the entire town. A fine waterworks is under construction, where the best modern pumping machinery will be installed. They are also adding an electric lighting plant.

Mr. G. F. Hardy, of New York, has been acting as consulting engineer for the company. The construction of the plant on such a large scale and the manner in which it is being built, show the ingenuity and mastery of modern engineering.

The officials of the Anglo-Newfoundland Development Co., Limited, are: Mason M. Beaton, president; Alex. Wood, treasurer; W. Scott, chief engineer; H. F. Lincoln, superintendent of construction; F. S. Pook, purchasing agent. These gentlemen are at Grand Falls at the present time, in charge of the construction work.

Grand Falls, Exploits River, Newfoundland.

Dam at Grand Falls, Exploits River, Newfoundlandf

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
CHICAGO - J. Purkis Sharpe 933-935 Monadnock Block
NEW YORK - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone 1111 Cortlandt

**PARIS**
FRANCE - John F. Jones & Co., 31bis, Faubourg Montmartre, Paris, France

**SWITZERLAND**
ZURICH - - Louis Wolf Orell Fussli & Co

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II SEPTEMBER, 1909 No. 9


## CONTENTS


The Municipal Hydro-Electric Works of Winnipeg, Man. - 17
Marine Developments - - - 20
Manitoba Power Line - - - 20
The Producer Gas Power Plant at the I.C.R. Shops, Moncton 21
N.S. Society of Engineers - - 24
Gas Engine Power Increasing - 24
Leather Belting - - - - - 25
The Westingbouse-Parsons Turbine; Toronto Instalation - 26
American Boiler Manufacturers' Association - - - - - 30
Winnipeg Power Plant - - - 31
Exhibits at Toronto Exhibition 31
Compressed Air and Vacuum Cleaning System - - - - 32
Three Wire D.C. Generators - 33
Large Electric Power Development in Newfoundland - - 34
Editorial - - - - - 35
Practical Articles by our Readers 38
Use of Chemicals for Boiler Troubles.
Unique Electric Gas Dynomometer.
Why Does the Engine Run Over?
Triple Expansion Engine Cards.
Correspondence and Discussion on Previous Articles - - 41
Boiler Design.
Dominion License Law.
Steam Pressure.
Information Wanted.
Some Questions for Thought.
Hot Bearings - - - - - 42
Ferro Marine Engines - - - 42
Canada's Water Power and the Marine Steam Turbine - - 43
Temperature Comparisons - - 44
New Equipment for Power Plants - - - - - 45
Watson St llman Automatic Tank Switch.
Peerless V-Belt.
Type "K" Jenkins Gate Valves.
Oil Pressure Hydraulic Turbine Governor.
Gas Producer.
Power Plant Developments - - 48
Power Supply Markets - - - 48
Catalogues - - - - - - 50


## NEW MACHINERY HALL NEEDED AT THE CANADIAN NATIONAL EXHIBITION.

The Canadian National Exhibition, Toronto, is a great exhibition. Everybody says so and everybody knows. But great as it is, it might be much greater. While there has been a great development along several different lines at the exhibition, there has been one line, machinery, that has been sadly neglected.

The exhibits this year in Machinery Hall, though very good, are nothing to what they might be, for the simple reason that there is so little space, that numerous exhibitors of previous years were unable to find room for their machinery. To the mechanical man and to the engineer there are very few exhibits to hold his attention for any length of time. The reason is simply this—there are neither facilities for placing the exhibits, nor room in which to display the machinery. The present cost of exhibiting in the building is simply enormous, compared with what the exhibitors receive in the way of advertising. There is no doubt that there is a woeful inadequacy of Machinery Hall, as a Machinery Hall.

A great number of exhibits which added very much to the educational features of the exhibition are this year conspicuous by their absence. The magnificent exhibit of the Canada Foundry and Canadian General Electric is no longer to be seen. The Allis-Chalmers-Bullock Co. is also absent. With the exception of two or three exhibits, the manufacturers and dealers in machine tools have found it impossible to arrange for exhibits. With proper facilities the Canadian Westinghouse and Northern Electric Co., instead of having little booths, might give an exhibit of power machinery that would attract the most prominent Canadian engineers, both consulting and stationery. The MacLean papers have for several years advocated a new Machinery Hall. This has been promised for the last few years, but has not materialized. There is little doubt that a new building, properly equipped would pay magnificently, as the following letter will show.

Toronto, Sept. 8, '09.

Dr. J. O. Orr, Manager,
The Canadian National Exhibition,
Toronto, Ontario.

Dear Sir,—We understand from press reports that your association contemplates the erection of a building for the sole use of British exhibitors. If this is actually the case, we herewith beg to make application for space in such a building, and we will guarantee to place on exhibition British made machinery and instruments to the value of not less than $50,000. The greater part of our apparatus would be so novel and yet so particularly adapted for the requirements of this country, that it would not only induce pre-eminent advertisement to ourselves, but would be of immeasurable benefit to your Exposition by reason of a demonstration of the very latest practice and development in the engineering profession. Our business is founded on the theory that there is a market in Canada for really high-grade machinery, and our success has proven how true this is. Kindly, therefore, let us hear from you at your earliest convenience in order that we can make necessary arrangements. You will remember that we did not exhibit this year as you could not see your way clear to allow us the space we desired.

Yours very truly,

VANDELEUR & NICHOLS,
Per R. H. N.

The fact is, that until a new Machinery Hall is built, manufacturers of machinery will have to use the blue sky for a covering, and this at a large expense, or else stay away from the Exhibition altogether. A building should be provided with a spur track running into it, and

an overhead crane running the whole length of it, so that the heaviest machinery could be easily transferred to its proper place. It was hoped by the manufacturers that this year would see some betterment of the situation, but matters are getting worse. More manufacturers wish to display their machinery, and to do so are compelled to take space where ever it could be had, some erecting tents, so that they might have a place at the Canadian National Exhibition.

Each year some improvement has been made in the way of a new building and each year Machinery Hall has been neglected. A new Dairy Building was put up a few years ago, also a new Art and Natural History Building, a Process Building, Horticultural Building, new Grand Stand and a Transportation Building, all of which are a credit to the Exhibition. The progress of Canada along machinery lines and the interest machinery men of Great Britain and United States are taking in the development of Canada, is a living protest against the scant attention which has been paid to machinery at the Exhibition. Canada is a country of national resources, and one of the chief agents in the development of these resources is machinery. Canada is blest with enormous water powers waiting to be developed, and the largest manufacturers of, or dealers in, electrical machinery in Canada are either absent or content with showing small electrical apparatus—how to make toast or heating irons for pressing clothes, etc.

In this issue of The Power House we publish a list of the exhibitors of power machinery. It will be noted that several large companies are absent on account of not being able to secure space. Considering all the drawbacks, however, inconveniences and lack of space, the exhibits are very good as far as they go. Interviewed by the editors of The Power House, the manufacturers are universal in their statements that they would have a much better exhibit of machinery were space available. There is only one exhibit for instance of gas producer plants, though this form of power is receiving great attention by mechanical men at the present time.

The whole issue may be summed up, that a modern Machinery Hall is needed at the Exhibition and that this hall can be made one of the best investments that the management could have. With such, manufacturers of and dealers in all lines of machinery and power supplies, will not only occupy space but will go to sufficient expense to make the exhibit of decided educative value. For instance, one dealer intimated that he was willing to spend $2,000 a year if he could secure space at the Exhibition. It will therefore be seen that, though the building will be erected only at considerable expense, the returns for that expense will be sufficient to justify the expenditure. The question should be looked at from all points, the educational value, the greater attraction for mechanical men, etc. If this is done, it will be seen tht a very liberal policy would be the best policy. Surely the exhibition directors will see the value in taking the step immediately to erect the new building, as a great percentage of the people of Canada are engaged in the practical end of manufacturing. We are in hopes that before the opening of the Canadian National Exhibition in 1910 we shall be able to announce that a new spacious and well equipped Machinery Hall, equipped with cranes and railway siding, has been added to the fine array of buildings.

## WHAT SHALL THE RATE BE?

Last February a body of North Americans, among whom were three Canadians, met in Washington, D.C. to confer as to the ways and means of conserving this continent's resources, or, in other words, to devise some method which would tend to check the prevalent waste in utilizing the gifts of nature. The result of this conference is already commencing to be felt in new regulations and amendments to old regulations relating to the development of our natural resources such as power from coal and water-fall.

These men drew up what is known as the "Declaratian of Principles," and among other things this "Declaration" has the following passage regarding the development and use of natural water sower :

"We regard the monopoly of waters and especially the monopoly of water power, as peculairly threatening. No rights to the use of water powers in streams should hereafter be granted in perpetuity. Each grant should be conditional upon prompt development, continued beneficial use, and the payment to the public for the rights enjoyed, and should be for a definite period only. Such period should be no longer than is required for personal safety of investment. The public authority should retain the right to re-adjust at stated periods the compensation to the public and to regulate the rates charged to the end that undue profit or extortion may be prevented."

This is perfectly reasonable. There should be no tying up of any water power, because those having the sole right to exploit it are laggards in carrying out their side of the agreement. The power is there for the people and the people should be given the use of it at the lowest possible expense consistent with a reasonable interest on the investment, or profit on the cost of development. The point is just here : Who is to decide what that profit should be ? The consumer or the development company ? And how ?

The last sentence of the above quotation is approaching the right goal, and already there are city councils and public service commissions throughout Canada that are endeavoring to solve the question as to how much should be charged for power. Caution must be exercised in this adjusting of rates and the pros. and cons. for each side should be carefully considered. Conditions vary enormously, and a rate for British Columbia could hardly be a fair foundation upon which to base rates for Ontario or Nova Scotia.

Often the city council which is trying to fix certain rates upon the power company is composed of men who are little able to judge the existing conditions, and who would probably not recognize a well defined explanation of cost and legitimate profit were they to see it. These men think, because in such-and-such a town power costs so much, that it should cost no more in their vicinity and endeavor to fix rates on the straight kilowatt hour basis, i.e., so much for the actual current used, without anything for "readiness-to-serve."

We have in mind an instance where the council of a small town got it into their heads that Jones, who owned and operated the small central plant, was charging too much and making an exorbitant profit. In vain Jones endeavored to show where his profit was no more than legitimate and if he were to run at the rates set down by the council it would be at a loss. They couldn't see it. Smith, of the town a few miles away, was delivering power for such and such a price, why couldn't Jones do the same? It didn't help Jones any, being on the opposite side of politics from the majority in council —a grave mistake surely on Jones' part. The upshot of the matter was a combine on the part of the light users in the town to order the current discontinued. Jones shut off "the juice," sat down and waited. He had worked hard over his power proposition and had been the pioneer of this development in that part of the country, starting with a small water power plant and then adding a steam auxiliary. His service was good, too, and, con-

sidering cost, his rates were fair, very fair, and he knew it. So he waited.

Now the ex-users of power are gradually coming back to users again and it looks as though Jones were going to win out. Now, he is exercising no monopoly but merely wants to have the right to charge fixed charges for fixed expenses and it was just this point that the council couldn't grasp, the "readiness-to-serve" charge.

The fact is, Jones is too up-to-date and progressive for his friends, the councilmen, and there are probably other councils and service commissions who are as much in the dark as to the correct basis to start from as the council herein mentioned. There seems to be no question but what the idea of fixed charges for fixed expenses is the correct basis upon which to build any schedule of rates that will be flexible enough to embrace the inevitable improvements in the efficieney of the power using apparatus of the future. Let this basis be firmly established and a large step will have been taken towards that goal—the highest conservation possible of our natural power, and the lowest consistent cost to the users of this power.

## BOILER ROOM ECONOMICS.

It is well known among engineers that boiler room economy and smokeless chimneys are inseparable. It does not follow that a smokeless chimney is a sign of economy in the boiler room, but the operator can rest assured that if the furnaces are run economically there will be no trouble from smoke nuisance.

Manufacturers and engineers are beginning to realize that a large per centage of B.t.u.'s are going up the stack and are turning their attention to improvement in their boilers, grates and draft apparatus.

Economy in the boiler room begins with the installation of the plant. Unless boilers of proper capacity, grates of suitable area and suitable draft apparatus are provided, no subsequent endeavor will raise the efficiency of that plant above the average. In determining beforehand the type of equipment to be installed, a careful balance should be struck between the first cost and the resulting fixed charges, and the expense for fuel, attendanee and repairs. Each engineer must settle this problem to his own satisfaction. If the plant is to be run continuously for twenty-four hours a day and seven days in the week, the owner can afford to pay fairly heavy interest and maintenance charges for the sake of improved boiler efficiency and diminution of labor account. A first-class water-tube boiler with mechanical stokers, coal-handling apparatus and forced draft may be an expensive investment, if only run sixty hours a week, while on the other hand, the saving of labor and the better fuel economy will more than pay the difference in running expenses for continuous operation.

The reason for the poor results shown in many boiler rooms is the fact that the engineer and fireman are entirely at the mercy of the coal dealer or buyer of factory supplies, and are unable to tell twenty-four hours ahead what variety of dirt they will be obliged to burn on the grates.

The buyer thinks he ean effect a saving in factory expenses by purchasing a grade poorer coal than has been used previously. The result is that coal is delivered at the boiler room, wholly different from the quality for which the grate is designed. The result is not all that may be desired and the company finds out in time that the fuel bill has been greatly increased. It is a false economy to try and save a few cents per ton in getting a poorer quality of coal and spending dollars to secure enough to get the required number of B.t.u.'s to keep the engines running.

Coal should not he bought by the ton without some guarantee as to its heating value. The most scientific method of determining this is by chemical analysis. If coal is bought from different fields where the chemical composition varies widely, it should always be purchased subject to analysis. In such cases, a sliding scale of prices can be adopted, the analysis or heat value of the samples submitted with the bid serving as a standard and a certain range of heat variation being allowed.

In burning coal under a boiler, the object is to transfer as much as possible of the total B.t.u. contained in the coal to the water in the hoiler.

No leak or waste is too small to deserve attention, and unceasing vigilance is the price of economy. The grates, if hand-fired, should be of standard shaking pattern and the fire kept thin enough so that it can be kept clean and bright without too much overhead slicing. Every time that the furnace door is opened for the introduction of coal or for cleaning the fire in any way, there is a distinct loss of efficiency on aceount of the inrush of cold air.

There is also the importance of good draft, and we mean to take this up fully in an early issue of The Power House. It is a question among engineers whether forced or induced draft gives the greater economy. There should always be a large excess of draft available. Chimneys should he built higher than actually necessary and if blowers are installed, they should he of sufficient capacity to furnish an excess of draft. The field of fuel, grates and draft, is a wide one. Every power plant owner and engineer should intesest himself in it. There is a chance for investigation into the economy securable by following up the points we have suggested, and in doing this, proprietors and operators will discover what "Boiler Room Economics" really means.

## TOPICS OF THE MONTH.

Dr. Frederick A. Cook and Robert Peary each claim to have reached the North Pole. Robert Peary is a well known successful explorer, who will give a full report of his findings. It has yet to be investigated what value this discovery is to science.

* * *

It is reported that Ambassador Bryce has returned from Ottawa to Washington with the assurance of Canada's adhesion to the International Waterways Treaty. Ninety per cent. of Niagara waters is on the Canadian side, while the generation of power is limited by a three-fifths clause. The Soo rider regulation respeeting the St. Mary's river, added by the United States Senate, is another feature of the treaty. The effeet of these two elauses should be very carefully considered. The sanetion of the Canadian Government should be withheld from any treaty which clearly does an injustiee to Canada.

* * *

By the new U. S. tariff the duty on soft coal has been reduced from 67e to 45c. This is a step in the right direction. Unfortunately the reciprocity clause has been omitted from the tariff. It would be advantageous to both United States and Canada to have the duty on soft coal removed.

# PRACTICAL ARTICLES BY OUR READERS

**Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.**

## USE OF CHEMICALS FOR BOILER TROUBLES.

By James E. Noble.

Numberless articles have been written about steam boiler practice and steam boiler explosions. Perhaps another one may show up some point not generally known. How many operating engineers stop to consider the terrible power stored up in one of the monsters they often carelessly look after? I remember reading an article by Professor Thurston, wherein he tells us that a cubic foot of water heated at constant volume until its pressure is 60 to 70 lbs. per sq. in. has about the same energy as a pound of gunpowder, and that the energy stored in a plain cylindrical steam boiler at 100 pounds gauge pressure, is sufficient to throw it a distance of 3½ miles.

Incrustation or scale is doubtless to blame for many boiler ruptures. It is a deposit familiar to every engineer, and is caused by the settling of mud or other matter, held in suspension in the feed water, or by the precipitation of mineral substances held in solution in the water. A covering scale of varying thickness may be formed according to the length of time it is allowed to accumulate, or to the amount of foreign matter in the water. A thick coating may become a source of danger as the heat from the furnace fire will only penetrate it very slowly, thus allowing the boiler plates to become overheated and weakened, and the boiler pressure may then be sufficient to rupture the overheated plate.

A very interesting table showing a list of scale-forming substances and corroding agents and the remedy for their treatment by simple chemical substances, is given by an authority on this class of boiler trouble. As it is not generally known in its entirety, I reproduce it for the benefit of your readers.

Other methods of more or less preventing scales in a steam boiler is by passing the feed water through a purifier before it enters the boiler. This is generally done by raising the temperature of the water, which causes the carbonates and sulphates in solution to be precipitated in the purifier. If there is an excess of foreign matter in suspension the water should be filtered. The frequent use of the blow-off, and surface blow-off is one of the readiest methods of removing impurities.

A number of volumes could be written on this one subject, but when everything is done by the filter, purifier or chemical process, as the case may be, the boiler attendant should enter his boiler at least once a month, and if any scale has formed, it should be removed with the proper tools.

External corrosion is a common thing, but it is very seldom a word is printed about it. It is fully as dangerous as internal corrosion, and, as in many cases, its existence is not suspected, it is liable to be one of the most dangerous foes to safety around a boiler-room. When a leak occurs around a joint hidden by brickwork, the plate may become corroded very much before it is discovered. As external corrosion is generally caused by dampness, all attendants should have a sharp lookout for any escape of water or steam around the brickword. A leak may be caused around a hidden seam by emptying the boiler when it is hot and filling it up again with cold water. The cold water entering the hot boiler causes strains on the seams by contraction. Leaving flue doors open at shut-down time is carried out to a greater extent than is generally credited by the careful class of engineers, and it is one of the worst things to do, as it places very unequal strains on the boiler. A leak may occur around water column pipes, especially the bottom connection where it enters the boiler and is hidden by brickwork. It should enter the front head to be correct. There are dozens of causes which might lead up to a boiler explosion, but external and internal corrosion are without doubt responsible for some of them.

| Troublesome substances. | Trouble. | Remedy. |
|---|---|---|
| Sediment, mud, etc | Scales | Filtering, blowing-off |
| Readily soluble salts | " | Blowing-off |
| Bicarbonate of lime | " | Heating feed water, adding caustic soda, lime or magnesia |
| Magnesium, iron | " | Same as above |
| Sulphate of lime | " | Adding carbonate of soda or barium chloride |
| Chloride and sulphate of magnesium | Corrosion | Same as above |
| Too much carbonate of soda | Priming | Adding barium chloride |
| Acid | Corrosion | Alkali |
| Dissolved carbonic acid and oxygen | " | Heating feed water, adding caustic soda, slacked lime, etc. |
| Grease from condensation | " | Filtering and slacked lime. Carbonate of soda. Substitute mineral oil. |
| Organic matter (sewage) | Priming | Precipitate with alum or chloride of iron and filter. |
| Organic matter | Corrosion | Same as above. |

## UNIQUE ELECTRIC GAS DYNOMOMETER.

By Frank C. Perkins.

The accompanying illustration and drawing shows a unique and interesting type of electric dynamometer for testing gasoline engines and other motors with accuracy, as to horse power output, and it also affords a most satisfactory means of determining the torque necessary for starting the engine, as well as for testing the engine frictional losses under various conditions of operation.

As noted in the drawing and photograph the electric dynamometer and engine are mounted on a structural steel supporting frame, with ball bearings, flexible coupling and measuring levers and weights.

The following formula is used :—

$$H.P. = \frac{W \times 2 D \times 3.1416 \times S}{33{,}000}$$

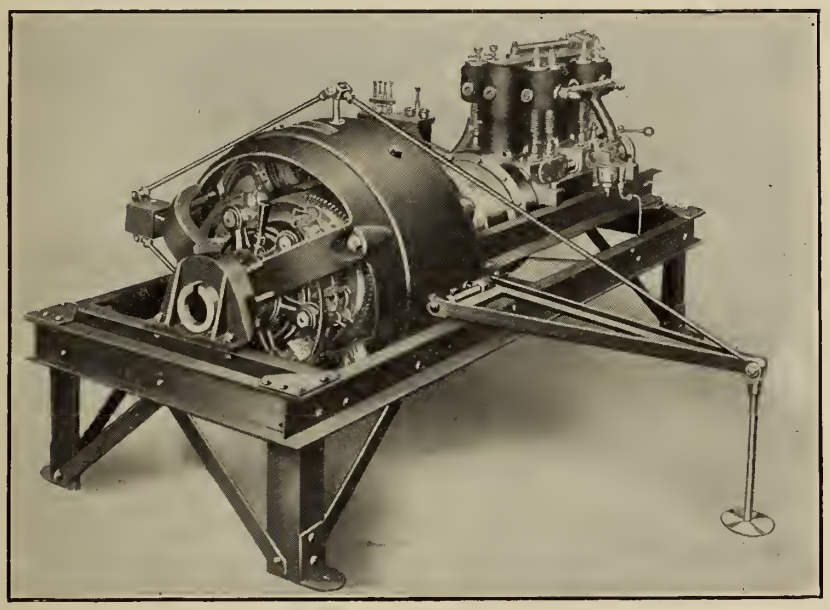
The horse power, H.P. being obtained by noting the weight W, in pounds on the hanger the distance, D, in feet from the centre of the armature to the weight and the speed, S, on the engine in revolutions per minute.

By providing a curve any mechanic can make the tests as the weight, W, and the speed, S, are the only variables, and by looking at the curve or tabulation, the horse power is shown without any calulations.

Many of the engine manufacturers still follow the old method of simply running the engine by its own power until the working parts run smoothly

without making any measurements of the power the engine developed, while in other cases variation in the friction or the oiling causes oscillations of the lever arm which render the readings more or less uncertain, and it is often difficult to maintain in full load constant and for any length of time on a friction brake without excessive heating.

These difficulties of the Prony brake



Unique Electric Gas Engine Dynamometer.

are serious when continuous and severe tests of engines are required and found necessary. The more up-to-date method is to couple the gas or gasoline engine to a dynamo and measure the electric current and voltage, but the losses in the dynamo must be carefully considered, and this task is often tedious. Hydraulic dynamometers are also largely used but these devices require very close adjustment and they are liable to stick at slow speeds. They have a limited speed variation and the objection of the water connections is more or less real, unhandy and unsatisfactory.

By the use of the electric dynamometer described and illustrated it is possible to use the dynamometer as an electric motor to start the engine, and thus save the labor of cranking, the current being taken from the shop circuit. During the tests it is also possible to utilize the electric power generated in testing the gasoline engines for supplementing the shop power current, operating the electric dynamometer in parallel with the shop generators.

There is a limit to the movement of the field frame, a stud being provided outside of the yoke, a slot being provided in forcing on the supporting frame. The arc through which the field frame moves by the armature is transmitted to the field frame.

This tends to rotate the field frame in the same direction as the armature is turning and by placing weight on the hanger arm the torque is readily measured and the horse power obtained from the above formula.

It cannot but be acknowledged that the electric dynamometer of this or other similar design provides an accurate and easy as well as a most efficient means of obtaining instantaneous values of the brake horse power of an engine while it may be operated for any length of time with full load upon it without excessive heating, in fact continuously as any other form of electrical generator.

It is a most satisfactory device for obtaining the brake horse power at different speeds, giving the results with great precission, the checking being also of great value as electric reading of ammeter, voltmeter and watt meter give the exact output of the dynamo in kilowatts and electrical horse power.

The only difference between this form of dynamometers and the ordinary Prony brake is that in the electric device, the electromagnetic reaction replaces the reaction of friction of the Prony brake. The special construction of this electric dynamometer consists of compensating poles on the direct current dynamo, the field frame being a cylindrical magnet to the inner side of which the poles with the coils are bolted and the field frame oscillates concentric with the armature, ball bearing supports being provided.

---

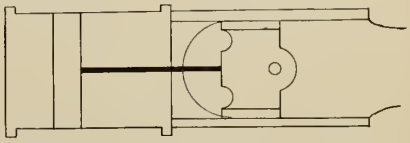
## WHY DOES AN ENGINE RUN OVER?

By M. C. Smith.

As a rule all stationary engines are set up and installed to "run over," right-hand or clockwise in order to have the slack of the belt running on top, thus giving far more adhesive surface to each pulley. But still this is not the real reason. Horizontal engines usually have for their weakest part, the top of the guide, and an engine running under, causes an upward force on the guide, and as I have noticed, will cause a great deal of vibration to the frame, especially of slow-speed engines like the Corliss, Wheelock, etc. When an engine runs over, the strain is just opposite, and being downward, its force acts on the heavy bed-plate or foundation. I have recently had charge of a 100 h.p. Corliss running under, and the top guide would vibrate so it could be seen actually 20 feet away, and I found it impossible to stop the excess heating of the top guide.

I have recently had a cause for a bad cylinder leak come to my notice. The cylinder was badly worn and when the piston was at either end it fitted fairly good, but upon reaching the mid position, as in sketch, the rod would ride on the gland, thus raising the piston and cause a bad blow, until the piston reached the other end.

Piston leaks are one of the very best preventors of economy and yet very few engineers think of looking there for them. I think one of the best ways of locating piston leaks is to remove the back cylinder head and place engine on dead centre and slightly open throttle. If the piston leaks the steam will be seen blowing past the piston. I found the other leak I mentioned accidentally, I removed cylinder head and was about to examine the follower bolts, etc., and



Leakage Occurred When Piston is in Centre Position.

as the piston was at the crank end, I opened the throttle. As the piston was moving back I heard the steam blow at mid position and upon inspection found just what I mentioned. Before that the piston was riding on the gland.

---

## TRIPLE EXPANSION ENGINE CARDS.

By John C. Tweedale.

I am submitting these cards, as taken from a regular run, under ordinary conditions, and trust the methods used for computing will be both instructive and useful to some brother engineer. The engines are triple expansion, of the inclined type, working with a steam pressure of 180 lbs. gauge, and a vacuum of 23 ins. The cylinders are 28x44x72 ins.,

with a stroke of 72 ins., operating at 31 r.p.m.

On account of such a long stroke, each cylinder has two valves, one at each end of the cylinder. The high pressure cylinder has piston valves, and the intermediate and low pressure cylinders have ordinary slide valves. Before adjusting, the high pressure cylinder, there was a loop on the crank end something similar to Fig. 1, which caused the engines when running very slow to stop on the back centre of the high pressure cylinder, owing to excessive compression. After adjustment the cards, as here shown, were obtained, showing a decided improvement.

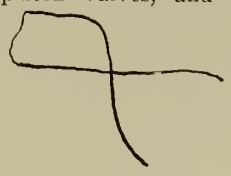


Fig. 1.—Loop.

In computing the I.h.p. it is, in my opinion, much easier to assume that all the work is done in the low pressure cylinder, instead of working each cylinder separately. This is done by reducing all the pressures to the area of the low pressure cylinder. By dividing the m.e.p. of each cylinder by the ratio of its volume, and the volume of the low pressure cylinder, all the work is brought down to one cylinder. The ratio of the areas of piston (which is the same thing as the volume) is 1:2.46:6.61. In this case, the high pressure reduced to the area of the low pressure, is

$$\frac{80}{6.61} = 12.1 \text{ lbs.}$$

The ratio of the intermediate and low pressure cylinder is

$$\frac{6.61}{2.46} = 2.687,$$

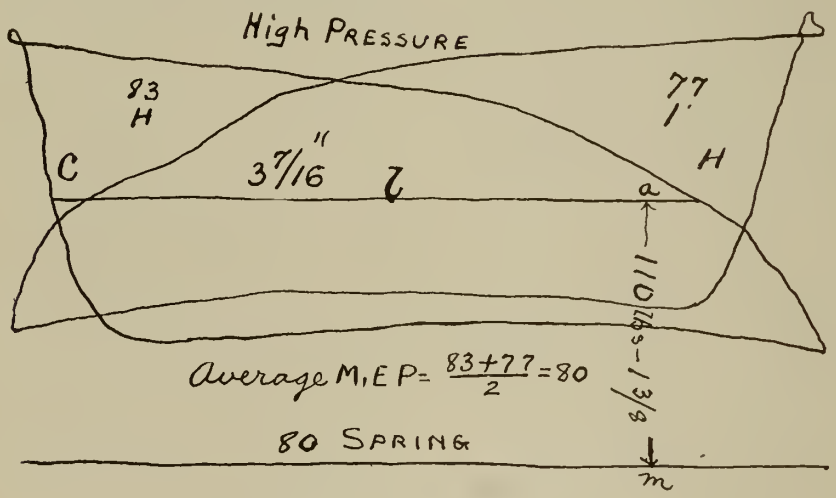



Fig. 2.—High Pressure Cylinder Cards.

and the m.e.p. reduced to the area of low pressure cylinder is

$$\frac{27.625}{2.687} = 10.28 \text{ lbs.}$$

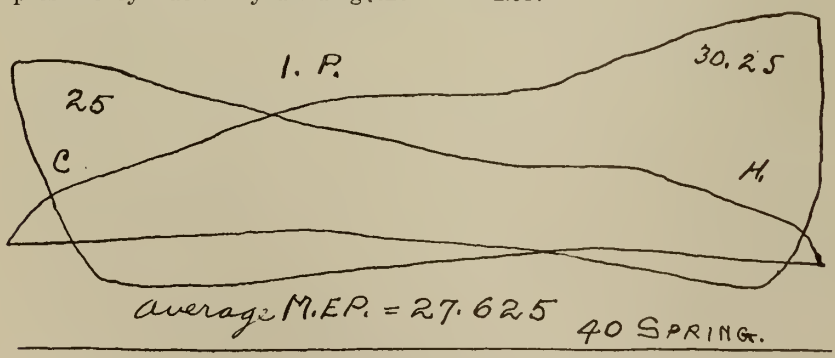



Fig. 3.—Intermediate Pressure Cylinder Cards.

The m.e.p. of the low pressure cylinder, of course, remains the same.

The total m.e.p. is 12.1+10.28+14.56 =37 lbs. nearly. The area of the low pressure cylinder is $72^2 \times .7854 = 4{,}071.51$ sq. in. We have now all the data to find the I.h.p.

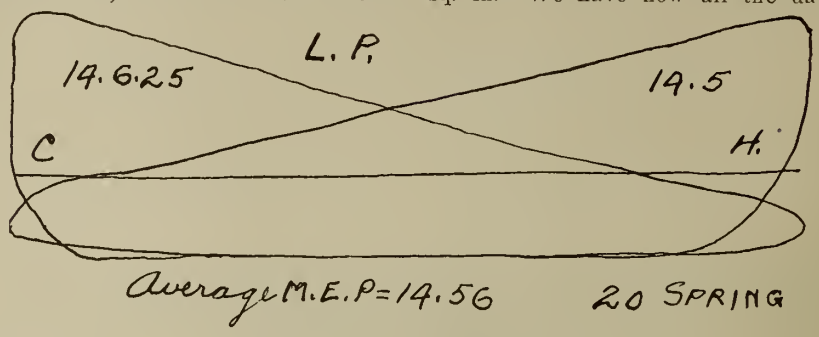



Fig. 4.—Low Pressure Cylinder Cards.

$$\text{I.h.p.} = \frac{\text{Plan}}{33{,}000}$$

and substituting we have

$$\frac{37 \times 6 \times 4071.51 \times 62}{33{,}000} = 1334.55 \text{ I.h.p.}$$

The steam consumption is taken from the high pressure cards. It is obtained from the following formula. Clearance can be neglected where there is a sufficient amount of compression:

$$Q = \frac{13.750 \times l \times w}{P \times L},$$

where Q=lbs. of steam per I.h.p. per hour, l=length of a line drawn on the card so as to strike a point on the compression line, and a point on the expansion line just before release. W=weight of one cubic foot of steam at the pressure am., P=m.e.p., L=total length of card.

From these figures we have

$$Q = \frac{13.750 \times 3.4375 \times .283598}{80 \times 4.25} = 39.4 \text{ lbs.}$$

per hour for the high pressure cylinder. The I.h.p. of the high pressure cylinder is 535, and the steam consumption will be

$$\frac{39.4 \times 535}{1335} = 15.7 \text{ lbs. for } 1334.55 \text{ I.h.p.}$$

## POWER CONSUMPTION OF CARS.

The power consumption of cars in watt hours per ton mile depends upon the schedule speed and the number of stops made per mile. For interurban cars, making a schedule speed of 35 miles per hour and making stops every 2½ miles, it would take about 90 watts per ton mile. For the average city cars it would take about 125 watts per ton mile.

## PLEASED WITH IT.

Editor The Power House.—I am forwarding you postal note for $1 in payment of my subscription to The Power House, kindly let me know if you received it or not. The monthly is O.K., and I am pleased with it. The Boiler number is fine and worth the dollar itself.

W. MARSHALL.

# Correspondence and Discussion on Previous Articles

Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### BOILER DESIGN.

I am a new subscriber to The Power House, the June (Boiler) number being the first one I have seen. I am greatly pleased with it.

As I hope soon to be a candidate for a second-class certificate, Mr. Wilkes' article is of more than special interest to me. It may be considered complimentary to the B. C. Act.

There is a point I would like you to explain to me, either through your columns or privately. On page 21 the figures substituted for the formula read:

$$\frac{.5184\times2\times23\times1.75\times4.2}{112\times3.125\times.4375}\times100=114\ \%$$

4.2 being the factor of safety.

Suppose that for reasons the factor of safety was 4.5, the percentage would then be 122, with a less efficient joint. Of course, in this case the rivet section is not the lowest percentage, so it doesn't count, but the increased factor of safety would, in finding the allowable working pressure on shell.

It is easy to find a boiler where the rivet percentage is the lower, where, by increasing the factor of safety, the percentage is raised, but not the allowable pressure on the shell, because in the one formula the factor of safety, being above the line balances, the same figures being below the line in the other formula, the results are the same, no matter what factor of safety is taken.

I hope I have made the point that puzzles me plain to you, but in working out the following it will be more so.

"Find the allowable working pressure on a boiler shell: Dia., 72 in.; plate 1⅛ in. thick; triple riveted with 1⅛ rivets; 5½ in. pitch; single butt strap joints. Take your factor of safety from Sec. 22, Book of Formula. Holes are fair and good, but have been punched after bending. Assume a suitable tensile strength."

"SAWDUST," B. C.

---

First of all, what is "The Factor of Safety?" It is the reciprocal of the ratio of the working pressure of a boiler to the pressure at which the boiler or any part of it may be expected to fail quickly (burst); in other words, it is the margin allowed between the bursting pressure and the working pressure.

The apparent factor of safety for some parts, like stay bolts, may be greater, but these are usually misleading because the stays, on account of unequal expansion, may be subjected to quite a degree of irregular stress. That is why the apparent stress on stay bolts, etc., from steam pressure is usually limited by law or inspection rules.

Corrosion is one of the worst enemies of the factor of safety of a boiler which has been some years in service. This action differs at the different parts, and the weakest part (i.e., the riveted joint) is seldom affected as much as the plate at some distance from the joint. The reason for this is that the plate is more or less protected by the rivet heads. It is often found that in old boilers which have "busted" the plates have failed outside the joint, due to corrosion.

On page 19 of June issue, at the top of the middle column it is shown that the bursting pressure of a cylindrical shell varies directly as the thickness of shell, and inversely as the diameter of the boiler, or

$$p=\frac{2\times t\times f}{d}$$

where

p=bursting strength,
t=thickness of plate,
f=tensile strength metal,
d=diameter of shell.

Consideration of this formula will show that there is only needed the introduction of the factor of safety to give us the formula for working boiler pressure; in other words, we simply reduce the pressure by dividing by our margin (factor of safety).

Thus (from our definition) the ratio,

$$\frac{p}{B}=F \text{ or } p=B\times F$$

Substituting the value of p we get

$$B=\frac{2t\times f}{d\times F}.$$

where

F=factor of safety,
B=working pressure.

This would be the case of a perfect shell with no seams whatever.

It will be seen that an increase in the factor of safety technically weakens the plate, as it really makes the working strength smaller. Now, when you come to work out the percentage strength of the rivets it is the percentage strength, as compared with the solid plate, that is considered, so when we technically weaken the plate the strength of the rivets, as compared with the weaker plate, is naturally stronger, or, in other words, the percentage is greater. That is why with a factor of 4.5, instead of 4.2, the percentage of the rivets in the formula you quote is 122, instead of 114, but the working pressure would be less because you have (technically) weakened the plate by increasing the ratio between bursting strength and working strength.

In working out the example you submitted, we have the factor of safety 4+(n—.15)+(c—.2)=4.35.

Then in our formula

A=1.107 since rivets are 1 3-16 in. diam, when driven; n=3; c=1; F=4.35; p=5.5; T=1.125, and we have

$$\frac{100\times1.107\times3\times23\times1\times4.35}{112\times5.5\times1.25}=47.94,$$

say 48 per cent.

This is a very low percentage and the cause is the thick plates and the fact that the rivets are in single shear. This illustrates why it becomes necessary, consistent with good workmanship, to put the rivets in double shear and increase the number of rows, when the plates become so thick.

Now if five were the factor of safety this rivet percentage would be increased to 55 per cent. of the strength of the solid plate because the plate is figured to be that much weaker.—The Editors.

---

### DOMINION LICENSE LAW.

Your editorial re uniform boiler law in the June issue of The Power House is very much to the point. Why not go a step further and have a boiler inspection and engineer's license law covering the whole Dominion. If a man is competent in one province he should be just as competent in the other, or, is it possible that one province has placed more value on life and property than another. I claim that every life and all property should be equally protected all over the Dominion.

I would, therefore, like to see you advocate through your journal, which no doubt, has a wide circulation, the necessity of this becoming a Dominion law.

PAT LAVELLE.

---

### STEAM PRESSURE.

At a meeting of the local C. A. S. E., No. 31, Wednesday night, Sept. 8, a question was brought up for discussion and there was a number of different opinions formed on the subject, which I would like to see answered through The Power House, and I will also enclose a stamped envelope for a private answer

by return mail if you will be kind enough to oblige me with an answer.

The question under discussion is, if we had a cylinder cover screwed onto a cylinder with ten studs, each screwed up to a tension of 1,000 pounds, and the face of the cover has an area of 100 square inches in contact with the steam when it is admitted to the cylinder, would there be any increased tension on the studs if steam was admitted into the cylinder at 80 pounds per square inch?

I think that there would not until the pressure admitted would be over 100 pounds.

SAM JONES.

## INFORMATION WANTED.

I note that you are kind enough to answer questions on engineering in The Power House, and shall be obliged if you would give me the following information. What is the capacity in 16 candle-power lights of a dynamo of 2½ k.w. power at 110 volts? Does a k.w. furnish a candle-power regardless of voltage and amperage?

L. P. LESLIE.

Hillcrest, Alta., 31st Aug., 1909.

## SOME QUESTIONS FOR THOUGHT.

The following letter was received from the Citadel Hotel, Cleveland, by the Secretary of the Canadian Manufacturers' Association. If any engineers can throw any light on the questions asked send your replies to The Power House, 10 Front Street East, Toronto:.

An old English machinist having spent much time in Canada, but now temporarily in this city would hereby submit several problems for your consideration and elucidation of your opinion respecting the commercial practicability of any or all of them respectively

First.—In England many years ago, having witnessed electric sparks freely evolved from steam issuing from the safety valve of a large boiler in ordinary operation, as an act of nature, and not of man's design, should it be deemed impracticable to so evolve electrical energy more economically than by present methods, by setting up conditions like to those which I saw? Surely it should be, and I think it is practicable.

What kind of a moter is used in the evolution of the lightning's flash?

Second.—Can calcium carbide be profitably used in further drying or using of partially dried peat, or lignite, by utilizing the resulting gases through the medium of producer gas engines, or other means, and passing the exhaust through other masses of peat?

Third.—Can we profitably evolve electric energy direct from water and calcium carbide gases, either with or without mechanical motion?

Fourth.—What can be the probable result from effectually closing the exhaust pipe near the high pressure cylinder of an engine, by means of an attachment whereby a valve in the exhaust pipe would be automatically closed by a breakage, or serious derangement of the governing device?

Bituminous coal and iron ore in the form of rounded boulders, or cobble stones are found in close proximity in the "Beeston Bed" of the "Lowmoor Iron Co.," Leeds, Yorks, England. Has the iron ore then, like to the coal, been evolved from vegetable matter? College professors tell us that the boulders owe their smooth rounded forms to their attrition by water. If so, why was the softer coal not so affected?

Practical — not theoretical — investigations have convinced me that the rounded boulders of iron ore are the products of the fruits of vegetable matter, while the coal is the product of the substance of the body of the vegetable matter.

A practical solution of even any one of the foregoing problems would be of considerable scientific and commercial value. A consensus of the opinion of your association of practical men on the respective problems cited, would be duly esteemed by,

JOHN W. PAYLOR.

## HOT BEARINGS.

By M. C. Smith.

There may be a more troublesome thing about an engine than a hot bearing, but I believe that very few of us happen to know of it.

There are a great many mixtures recommended for avoiding and also for curing, which is the subject here. Flake graphite is commonly known to almost every engineer, and is considered about the best friction reducer available, but still there are others often used with good results. Of course, when a bearing is found to be gradually getting warmer, the first thing to do is increase the oil feed and make sure the oil holes are open. If the bearing still continues to get hotter, feed a little graphite, powdered soapstone or sulphur with the oil, and as a last resource, introduce a little aqua ammonia, which will convert the oil into soap by saponification, soap being an excellent lubricant. It must be understood that mineral oils will not saponify.

In reading over a paper of recent issue, I ran across an article on "Points for Gas Engine Operators." This, of course, is out of my line, but may be of interest to some one.

After you have purchased an engine remember that you have not secured a machine which will solve perpetual motion problem. A gas engine will stand a great amount of abuse, but bear in mind that it cannot deliver its best service unless the operator gives it at least some kind of attention. Be sure engine is oiled at all times. Never fail to have the cooling water on while engine is running. The clyinder should not get too hot or cold; about 180 degrees is right temperature. Be sure the vent holes in gasolene tank is open. If anything goes wrong, do not pull the engine apart—the engine, nine cases out of ten, can be remedied by going over carefully or systematically. It seems almost necessary to warn the engineer not to smoke in the engine room.

The open-flame lamp should be kept as far away as possible. In examining the exterior of the cylinder, care should be taken so that the candle or match, when put in the cylinder, will, if a charge happens to be present, not burn the face or hands. Do not use steam engine oil to lubricate a gas engine. The manufacturer of a gas engine is the best authority on what oil is best for his particular engine. Consult the manufacturer when in doubt.

## FERRO MARINE ENGINES.

Realizing the great field for motor boats and marine engines in the Province of Quebec, Williams & Wilson, Montreal, are adding a department for the sale of marine gasolene engines and supplies, to their organization. They have arranged to act as distributors for the Ferro marine engines in the Province of Quebec.

A large stock of Ferro engines, Ferro reverse gears and repair parts will be maintained in Montreal. This makes it possible for Quebec agents to obtain quick shipment and affords a convenient demonstrating point for Canadian customers.

## A WELCOME VISITOR.

Editor The Power House.—The Power House is improving every issue and is always a welcome visitor to our plant. May you continue to have success with your undertaking.

F. H. CHESHER.

Chief Engineer
Belleville Iron & Horseshoe Co.

R. R. Kelly, M. Can. Soc. C.E., formerly city engineer of Edmonton, Alta., has been appointed Professor of Electric Engineering in Nova Scotia Technical College, Halifax.

F. E. Leonard of E. Leonard & Sons, London and J. J. Main, Polson Iron Works, Toronto, attended the annual convention of the American Boiler Manufacturers' Association, Detroit, Aug. 10 to 12.

## CANADA'S WATER POWER AND THE MARINE STEAM TURBINE.

By Sir W. H. White, K.C.B., Sc.D.

Canada has unrivalled resources in water power, and its extent and possible utilization have been made the subject of investigation by engineers for many years past. In recent times many engineers have studied the subject, and carried out important works. Exact knowledge of the total power represented by the water-falls and rapids of the Dominion is not available, nor can any close estimate be made of the power which may be employed hereafter in factories, mills, or industrial processes, because profitable employment obviously depends upon commercial considerations, which must be governed largely by the localities in which water-power may be found, and the cost of works and of transmission of energy to places where it can be utilized. It has been estimated that on the line from Lake Superior through the chain of lakes and rivers leading to Niagara, and thence through the St. Lawrence to the sea, 11,000,000 horse-power may be developed. Mr. Langelier has estimated that in the province of Quebec the water-power aggregates more than 18,000,000 horse-power; other provinces all possess large resources of the same kind as yet untouched.

The most striking example of the utilization of water-power is that on the Niagara River, which the writer had the good fortune to visit in 1904, during his presidency of the Institution of Civil Engineers. The works on the Canadian side were then in full progress, and at a stage which enabled one to realize completely their great difficulty and immense scale. The three companies whose works are near the Falls on the Canadian side have provided for a total ultimate development of over 400,000 horse-power, and a fourth establishment lower down the river, intended chiefly for the use of Hamilton, is to develop 40,000 horse-power. In the construction of the works, in the electric generating plant, the arrangements for transmitting power over long distances, and other features of importance, remarkable engineering skill and daring have been displayed. American capital and enterprise have had much to do with these undertakings, as they have with many other important Canadian enterprises; but it may be hoped that British capital will keep its lead, and be freely employed in the development and utilization of all the resources of the Dominion, including that magnificent asset, its water-power. The applications of water-power are already very numerous, including not merely the creation of electrical energy, and its use for lighting and power in towns and factories situated at considerable distances from the falls, but for manufactures and industrial processes carried on near the falls. Amongst these manufactures that of aluminium and carbide of calcium may be mentioned; while paper and pulp-mills and saw mills constitute important industries. Great advances have been made in the transmission of electrical power over long distances, and very high pressures are being used. Electric traction on railways and tramways also derives its power from the same sources, and is being rapidly developed. In 1901 there were 553 miles of electric railways, and in 1907, 815 miles.

### The Marine Steam Turbine.

The rapid development of the marine steam turbine during the last seven years constitutes one of the romances of engineering, and the magnitude of the work done and the revolution initiated by Charles Parsons will be more justly appreciated hereafter than it can be at present. In some quarters there is a tendency to deal critically with details and to disregard broader views of the situation as it stands today. In May, 1909, there were 273 vessels built and under construction in which steam turbines of the Parsons type are employed, the total horse-power being more than three and a half millions. In the Royal Navy every new warship, from the torpedo-boat up to the largest battleships and armored cruisers, is fitted with turbine engines; and the performances of vessels which have been tested on service have been completely satisfactory, in many instances surpassing all records for powers developed and speeds attained. In the war-fleets of the world this example is being imitated, although in some cases it was at first criticized or condemned. In the mercantile marine as a whole, while the new system has not made equal advance, many notable examples can be found of what can be accomplished by its adoption. It is now admitted that steam turbines enable higher speeds to be attained in vessels of given dimensions; and in steamers built for cross-channel and special services, where high speed is essential and coal consumption relatively unimportant, turbines have already ousted reciprocating engines. For oversea service and long voyages an impression has existed that the coal consumption of turbine-engined ships would considerably exceed those of ships driven by triple or quadruple expansion reciprocating engines. Critics have dwelt on the reticence in regard to actual rates of coal consumption practised by owners of turbine steamships. Naturally there are other reasons for reticence than those which would arise if the coal consumption were excessive; but pioneers in the use of turbine machinery may reasonably claim the right of non-publication of results or trials in the making of which they have incurred large expenditure and taken considerable risks if they think that silence is beneficial to their business interests. Even if it were true that in the earliest applications of the new system economic results had not been obtained equal to those realized in reciprocating engines which have been gradually improved during half a century, that circumstances should not be regarded as a bar to acceptance of a type of engine that admittedly possesses very great advantages in other ways, but should be regarded as an incentive to improvements that would secure greater economy of coal. The evidence available, however, does not confirm the adverse view, and those familiar with the facts do not admit its truth. One example may be cited as it affects the Canadian service. In June, 1907, it was authoritatively stated that in the Allan Liner "Virginian" the reports which had been circulated respecting the excessive coal consumption were unfounded, that the vessel was making passages at speeds of 17⅝ to 17¾ knots, as against the 17 knots estimated, and the rate of coal consumption was really about 1.4 lbs. per indicated horse-power which would have been required to attain this speed if the vessel had been fitted with reciprocating engines. This result compares well with the consumption in ordinary passenger steamers running at high speeds in proportion to their dimensions, although in large cargo steamers and vessels of the intermediate type, working under much easier conditions and at very low speeds, in proportion to dimensions, lower rates of consumption may be obtained. With these latter vessels the fair comparison is the combination system and not the pure turbine type which is adapted for high speeds.

The crowning triumph of the steam turbine up to the present time is to be found in the great Cunard steamships "Lusitania" and "Mauretania." The passages made this year by the latter ship since she was refitted have been marvellously regular, and the 25 knots average across the Atlantic, which was the maximum contemplated in the agreement between the Government and the Cunard Company, has been continuously exceeded. As one intimately concerned with the design of the "Mauretania," who has had large experience in ship design, has made a life-long study of the laws of steam-

*Abstracts of address to Engineering Section of British Association for Advancement of Science, Winnipeg, 1909.

ship performance, and had the honor of serving on the committee which recommended the employment of turbines in these great ships, the writer ventures to assert that equal results could not possibly have been obtained with reciprocating engines in vessels of the same form and dimensions. Contrary opinions have been expressed, but they have been either based upon incorrect data or have omitted consideration of the fact that in vessels of such great engine-power it was necessary to have time to perfect the organization of the staff in order to secure uniform conditions of stoking and steam production, and to bring the "human element" into a condition which would ensure the highest degree of efficiency in working the propelling apparatus. This necessity for time and training has been illustrated again and again in the case of new types of Transatlantic steamers, including some which held the record for speed prior to the appearance of the Cunarders. In the "Lusitania" and "Mauretania" the engine-power is fully 60 per cent. greater than that of their swiftest predecessors, yet no similar allowance appears to have been thought necessary by some critics, who assumed that performances on the earlier voyages represented the maximum capabilities of the vessels. Subsequent events have shown this view to be fallacious and have justified the recommendation of the Turbine Committee and the action of the Cunard directors. Allegations made in regard to excessive coal consumption have also been disproved by experience; and in this respect the anticipations of the committee and of Mr. Parsons have been fully realized.

## TEMPERATURE COMPARISONS.

A simple rule to follow in changing Fahrenheit readings to centigrade is

$$C = \frac{5}{9}(F - 32)$$

Supposing F=212 degrees, or boiling point of water, on the Fahrenheit thermometer. Then $C = \frac{5}{9}(212 - 32) = 100$ degrees, or the boiling point of water on the centigrade scale.

Any reading on either scale may be converted into the other by this simple formula. Freezing point centigrade is 0 degrees. Substituting this in the formula we have

$$0 = \frac{5}{9}(F - 32)$$

from which it is evident that F=32 degrees.

There will be one point on the thermometer when F will equal —C. To find this point the formula becomes

$$C = \frac{5}{9}(-C - 32).$$

$$9C = -5C - 160.$$

$$14C = -160.$$

$$C = 11.42.$$

I have had a number of engineers ask me how to convert one temperature to the other and have given them this simple equation.

## CHEAPER GAS MANTLES.

According to the Gas World, the Association of German Manufacturers of Thorium Nitrate, who provide almost exclusively the raw material for the making of mantles, have been compelled to reduce their prices about 20 per cent. as a result of the throwing on the market of a large quantity of monazite sand at a very low price. Owing to monazite sand being now obtained from several other places besides Brazil, the supply of thorium has outstripped the demand, and as the producers are either unable or disinclined to pool their interests, mantle makers are likely to get their mineral supplies at exceptionally low prices for some time to come. This ought to be good news for dealers in gas-lighting materials, because when first-class mantles are to be had cheaply people can afford to throw them away when only just past their prime instead of keeping them in use after they are dilapidated and inefficient.

## PERSONAL NOTES.

C. H. Cahan, Montreal, has been elected president of the Western Canada Power Co. A plant will be erected at Stave Lake, near Vancouver.

W. H. Adams, 102 Nazareth St., Montreal, has been appointed agent for the sale of Turbo-Blower Systems of mechanical draft for Ontario, Quebec, New Brunswick and Nova Scotia.

F. W. Bailey, of the Magnolia Metal Co., New York, has been appointed general manager of the Canadian end of the business. Mr. Bailey has taken up his residence in Montreal.

C. H. Mitchell, of Messrs, C. H. and P. H. Mitchell, consulting engineers, Toronto, has gone to Prince Albert, Sask., where he will report on a power plant.

Roderick Perry Curtis, president of the Curtis & Curtis Co., Bridgeport, Conn., died on Monday evening, August 9th, at 6.10 o'clock, at Southport, Conn., the result of an automobile accident which occurred several weeks ago, in the vicinity of Westerly, R.I.

## OPPORTUNITY.

"Opportchunity," says Mr. Dooley, "knocks at iv'ry man's dure wanst. On some men's dures it hammers till it breaks down th' dure, an' then goes in an' wakes him up if he's asleep, an' aftherwards it wurruks f'r him as a nightwatchman."

Nearly all the British ocean-going destroyers have been suffering from furnace defects. The replacement of the burners is, of course, an anticipated necessity, though not of very frequent occurrence; but special care has to be taken that the quality of firebrick employed will withstand the greater heat, and the system of attaching these bricks was not as good as it might have been in one or two cases.—Engineer.

One of the large new steamers of the Orient Steam Navigation Co. plying between England and Australia has been provided with a model electric equipment, even including an electric laundry. The wash is first boiled in a tank, where the water is kept at boiling point by means of steam pipes; thence it is carried to a pair of washing machines driven by an electric motor. The clothing is dried by means of a hydro-extractor driven at 610 revolutions per minute by a 2-horse-power motor. There is a Decoudon machine driven by an electric motor, which is provided with a safety device to prevent the operator's fingers from being caught under the rollers. If the fingers come too near the roller, the motor which drives the machine is automatically stopped. The laundry is equipped with an electrically-driven ironing machine and with several electric irons.—Scientific American.

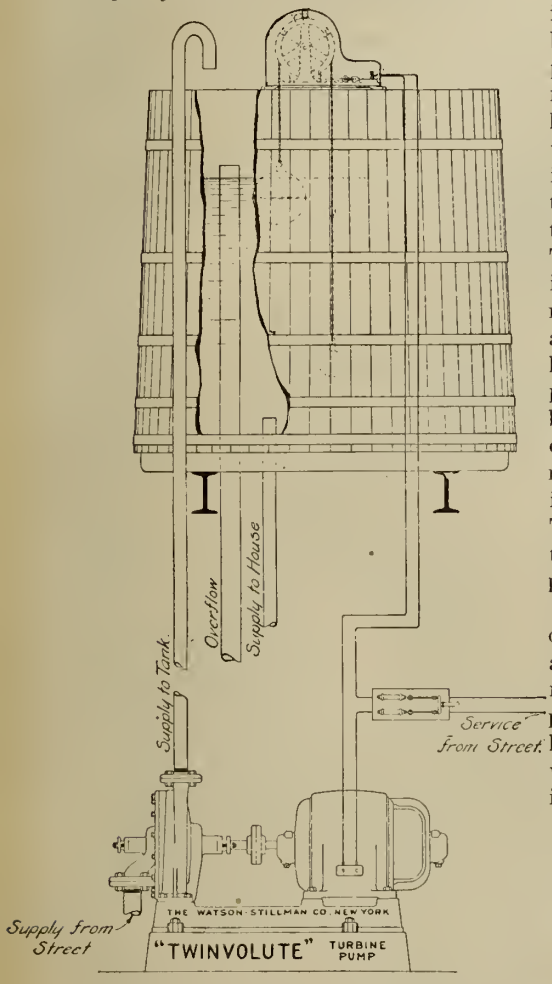
From time to time we hear of some enterprising amateur driving an electric generator by means of a windmill, and thus obtaining electricity without cost except that of the installation, and with it lighting his house and operating various household machinery. Recently a German company has gotten up a special electric generator equipment adapted to be operated by wind power. The installation comprises a dynamo and a storage battery, the latter serving to store the excess power until such time as it is required. The apparatus is entirely automatic, and requires absolutely no attention except in time of storm, when it is necessary to reduce the sail area of the wind wheel. A special regulator used with this apparatus automatically keeps a constant pressure on the lighting circuit, this being entirely independent of the number of revolutions of the dynamo or the condition of the storage battery.—Scientific American.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### WATSON-STILLMAN AUTOMATIC TANK SWITCH.

This device is offered as a decided improvement over other switches for automatically maintaining the water level between desired limits in open tank or sump systems. The construction is




Action of Watson-Stillman Switch, Starts Motor and Turbine Pumps When Water gets Below Limit.

novel, permitting the switch to be placed on top of the tank or sump cover, and permitting any desired variation in water levels to be carried without relocating the electrical apparatus. When the switch is placed on top of the tank, as in this instance, there is no danger of the switch flooding and becoming short-circuited.

The operation of the Watson-Stillman switch in starting and stopping the motor is dependent upon the movement of a falling hammer, the movement of which in turn is governed by a freely suspended copper float nearly counterbalanced by a cast iron ball. Referring to the illustration of the interior mechanism, which is shown arranged for tank service, the two small wooden balls on the chain are adjustable and their position determines the variation of water level between operations of the pump. In the interior view, the switch is shown as when the pump is in operation. As the float rises, the ball A comes into contact with the projection F on the hammer and carries the hammer past the centre. The hammer then falls to the other side of the pulley shaft by gravity, and in doing so, the lug L strikes a projection on the switch and disengages the knife, thus stopping the motor and pump. The switch movement is quick. There is no chance for arcing and as the hammer remains in contact with the switch arm, there can be no rebound. The hammer holds the switch arm in this position until falling of the water level brings the other wooden ball B into contact with the hammer lug, which reverses the hammer, throws the knife into contact and starts the pump again. The wheel acts merely as a carrier for the copper chain. It plays no other part in the operation of the switch.

As arranged for draining sumps, the copper float and iron ball are reversed as shown in the exterior view. This reverses the switch action to start the pump when the water level gets too high. Dampness will not affect the working qualities of the switch when it is placed in the pit.

The knife arm is thoroughly insulated from every other part of the switch and the two contact points are mounted upon a slate block. A suitable opening is provided in the body for inserting the tube and making the connection to the binding posts. No parts of the switch need oiling or other attention. The shaft is bronze to prevent corrosion and all parts are extra strong. All working parts are enclosed in a heavy cast iron case which protects them from the weather and from sudden injury.

This switch may be had single or double pole and for all ordinary currents and voltages. It is made by the Watson-Stillman Co., 50 Church St., New York.

---

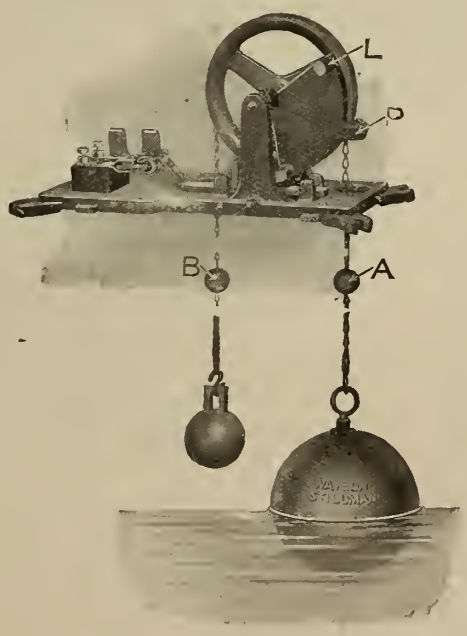
### PEERLESS V-BELT. CO.

On page 45 of the August issue of The Power House appeared a description of the Peerless V-Belt. This is manufactured by the Peerless V-Belt Co., 215-219 So. Clinton St., Chicago.

---

### TYPE "K" JENKINS GATE VALVES

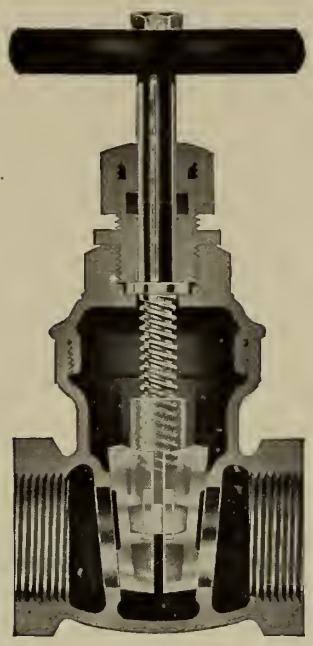
Reference to the sectional illustration will show that these valves are designed on novel and excellent lines. The body is globe-shaped, which, with the even distribution of the metal, insures great rigidity and strength—preventing distortion due to strain or shock. All parts are carefully machined to gauge.




Interior View of W.-S. Switch Arranged for Service.

Exterior View W.-S. Switch Arranged for Sump Drainage.

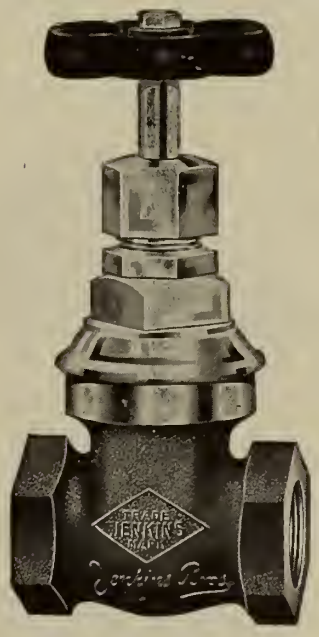
In the construction of the discs are employed a combination of the solid-wedge, and the split-wedge principles, thereby producing a mechanism which adds to the ease of operation and clos-



Section Type K. Jenkins Gate Valve.

ing. The discs are carried on a spindle-nut, so constructed as to act as a wedge at the point of closing, and, at the same time, allowing a certain amount of flexibility.

The valve body is provided with guides which prevent the discs from coming in




New Type K. Jenkins Gate Valve.

contact with the seats until completely closed. Unlike the solid-wedge, the discs cannot jam in the valve body, for the first movement of the spindle loosens the discs, and the guides remove them from the seat faces.

To re-assemble the valve, place the two discs and spindle-nut together and drop them into the valve body. Then screw the spindle into the spindle-nut until the discs are lifted clear of the seats, when the bonnet may be screwed down tight.

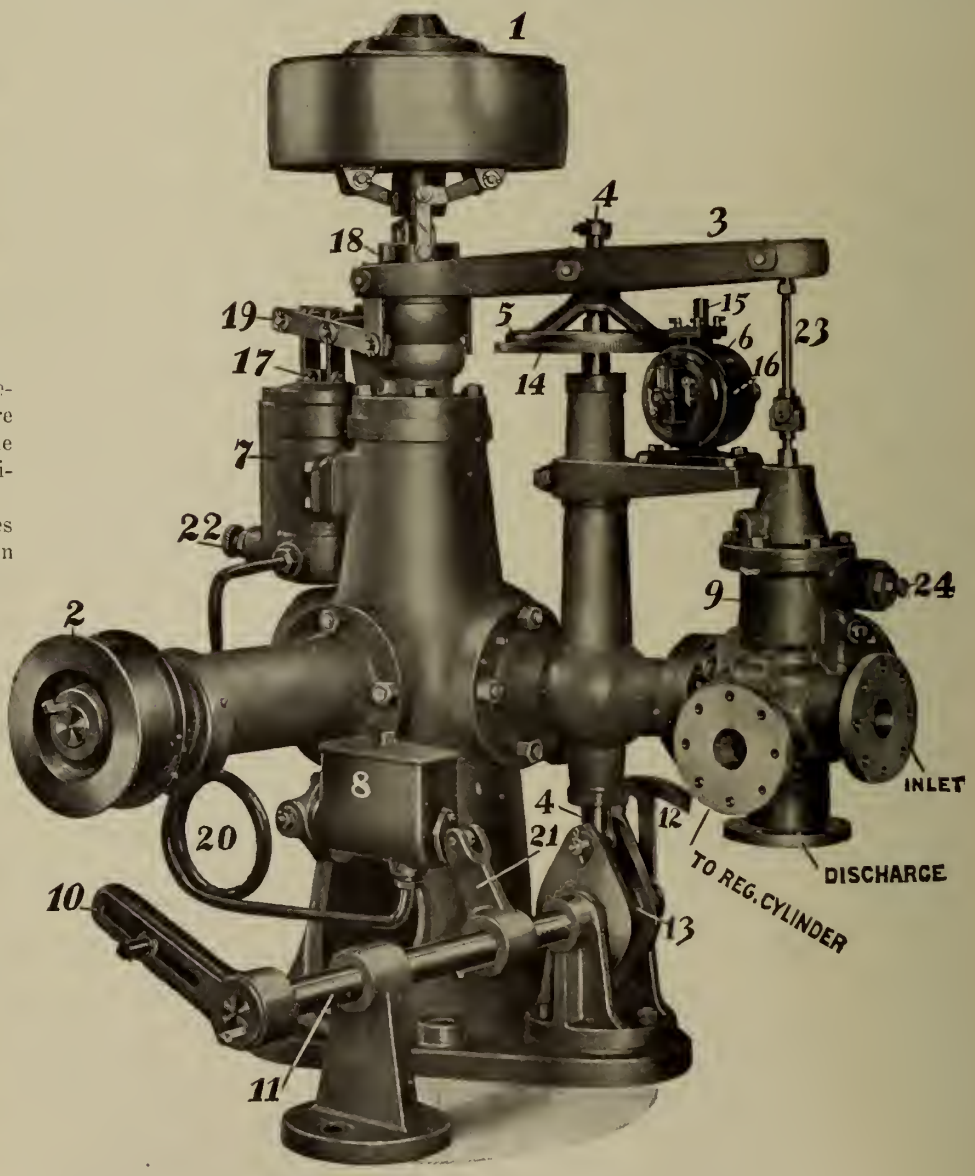
These type "K" gate valves are the latest production of Jenkins Bros., St. Remi St. and Acorn Ave., Montreal, P.Q.

---

## OIL PRESSURE HYDRAULIC TURBINE GOVERNOR.

This governor is of new design. It is constructed so as to overcome, as far as possible, the sacrifice of sensitiveness entailed by providing sufficient power to actuate the regulating valve, in preventing over travel and consequent hunting, etc. It is made in two sizes, and in both the regulating valve is actuated without mechanical connection with the governing element through unbalanced pressure, with no sacrifice of sensitiveness or quickness. The danger of over travel or hunting is eliminated by the use of a device termed a compensating dash pot.

The governor consists of three distinct elements, the governor stand containing the apparatus for controlling the time of application of the energy used in actuating the gates, the regulating cylinder for applying energy and the pressure system for supplying the energy. The governor head (1) is driven from the turbine shaft and any change in its position moves the governor collar (18), thereby shifting the floating lever (3). This lever and its connection with the relay (4) actuates the regulating valve (9), the relay acting momentarily as a fulcrum. Any movement of the regulating valve admits oil from the pressure system to either the opening or closing side of the regulating cylinder and thereby actuates the turbine gates.




Allis Chalmers Oil Pressure Hydraulic Turbine Pump.

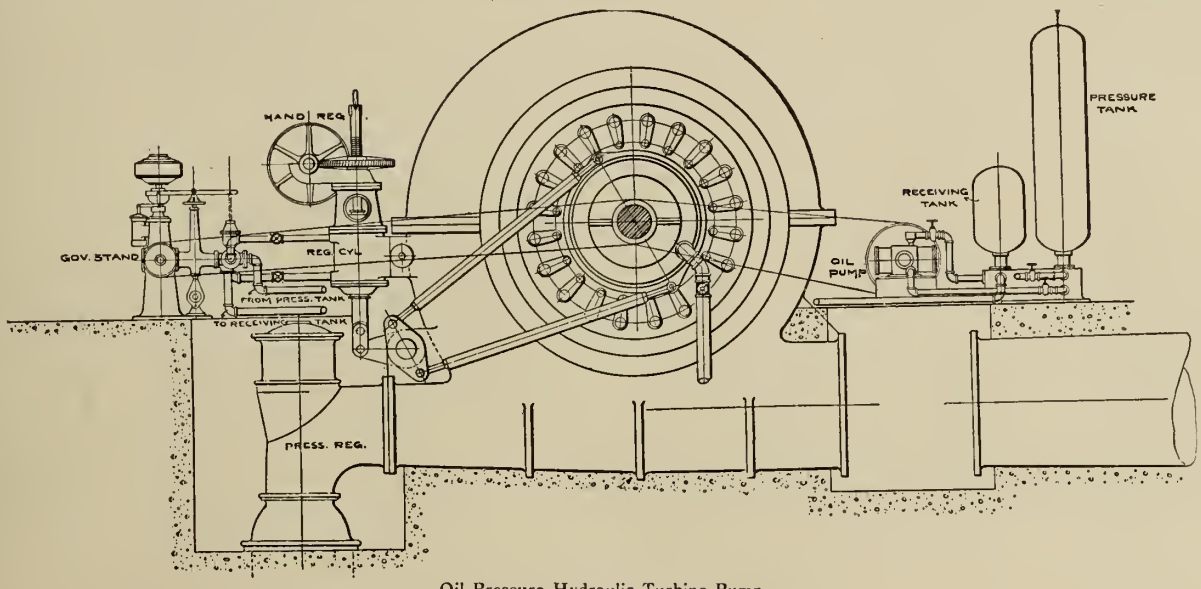
Under favorable conditions, with open flume and short penstocks, the

opening and closing time of the gates depends solely upon the inertia of the moving masses and the stroke of the regulating piston and the travel of the governor collar can be made to correspond in time. With long penstocks, however, the closing time is often so influenced by the length of the moving masses and other considerations that it is no longer practical to have the travels of the collar and regulating piston correspond, since a travel of the collar would be required that would cause a greater difference in speed between no load and full load than is commercially allowable. To meet such conditions, the compensating dash pot is used. This consists of a cylinder (7) having an adjustable by-pass and containing a compound piston with auxiliary spring device, the rod of which is connected, through a suitable lever, to the governor collar. Connected by a pipe to the dash pot cylinder is a positive displacement pump so arranged that its piston receives its motion from the relay actuating shaft. For slight changes of load, a negligible displacement of oil takes place, and the dash pot has only a slight damping action on the governor head, but when any load change occurs of sufficient magnitude to cause a greater variation of speed than allowable, enough oil displacement takes place to bring the auxiliary spring effect of the dash pot piston into action until the fluctuation is controlled. By this means, a governing element of maximum sensitiveness can be used and the regulation of ordinary slight fluctuations made "aperiodical" i.e. the stroke of the regulating piston and the travel of the governor collar correspond in time. These elements in design, therefore, result in this governor operating quickly and holding the speed variation within very narrow limits, yet being free from hunting or over travel after heavy load fluctuation.

This governor is made by Allis-Chalmers-Bullock Co., Montreal.

## GAS PRODUCER.

Goldie & McCulloch, Galt, Ont., are manufacturing a gas producer for use in conjunction with the gas engine, recently placed on the market by them. A full description of the engine appeared in the January issue of The Power House.




Oil Pressure Hydraulic Turbine Pump.

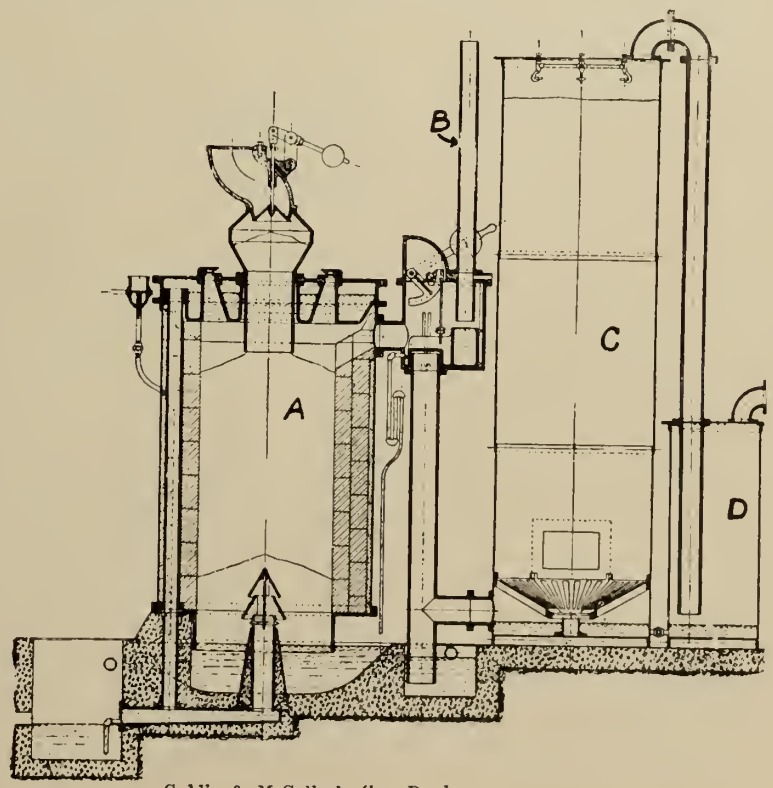
In the gas producer, herewith illustrated A is the producer, B the purge stack, C the scrubber and D the expansion tank.

The generator is not provided with any grates but the fire is built upon a bed of ashes which rests on the foundation. The ashes can be removed at any time through the water seal without opening up the generator, and this feature makes it possible to run the producer continuously without any interruption.

The vaporizer is in the shape of a shallow pan placed directly over the fire at the top of the generator and steam is admitted by a down pipe through a central tuyere casting with umbrella top. The sides of the generator lining are vertical which allows the fire to be easily poked and eliminates any danger of "bridging."

The vent valve is so arranged that when the engine is running the opening to the stack is water sealed.

The scrubber is of the "wet" type and a sufficient expansion tank is provided to keep the draft approximately constant.




Goldie & McCulloch Gas Producer.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Electrical Notes.

The city of Toronto, Canada, will shortly call for tenders for pole line supplies, including copper and aluminum conductors, poles, cross-arms, pins, braces, etc., etc. For information apply electrical department, city hall.

Tenders will be received by the city of Toronto, Canada, up till noon of Thursday, October 14th, for the following electric motors. For specifications and form of tender apply the city engineer. 4—1500 h.p. synchronous motors, 2—1500 h.p. induction motors, 4—500 h.p. synchronous motors, 4—500 h.p. induction motors, 2—225 h.p. synchronous motors. With exciters, switchboards, connecting material, etc.

Jens, Orten-Boving and Co., of 9½ Union-Court, Old Broad-street, London, have received through Messrs. Smith, Kerry & Chace, Toronto, an order from the Calgary Electric Power Co., Calgary, for two water turbines of 750 h.p. each, and another from Mines Power (Limited) for the governors of four 2750-h.p. Francis turbines. A further order is for two pumps, to deliver 200 gallons per minute, against a head of 35ft., which will be manufactured by Villans & Robinson, Rugby.

The Canadian Light & Power Company of Montreal have awarded a contract to J. E. White & Co., of New York for the develop-work in connection with their water-power plant at Beauharnois. The present initial development provides for 21,600 shaft horsepower, with such further developments as may be required in the near future. It is estimated that the present initial development will cost about $4,000,000. The work of deepening the old Beauharnois Canal will be begun immediately.

Tenders will be received by the city of Toronto, Canada, up till noon of Thursday, October 14th, for the following turbine pumps. For specifications and form of tender apply to the city engineer. 4—13½ million gallon pumps, 100 pounds pressure; 2—5 million gallon pumps, 300 pounds pressure; 2—10 million gallon pumps, 65 pounds pressure; 2—10 million gallon pumps, 110 pounds pressure; 2—6½ million gallon pumps, 90 pounds pressure; 2—6½ million gallon pumps, 160 pounds pressure; 2—1½ million gallon pumps, 65 pounds pressure; 2—1½ million gallon pumps, 110 lbs. pressure. With valves, piping, bed plates, couplings, etc.

A. Gronwall, Ludvika, Sweden, is in Ottawa in connection with proposals now under way to establish furnaces in Canada for the electric smelting of iron ores, on the same principle as is now in successful operation in Sweden. Mr. Gronwall is one of the three Swedish engineers who have spent the last three years in perfecting the electric smelting process along the lines first laid down by Dr. Haanel, Deputy Minister of Mines for Canada. Louis Simpson, Ottawa, who has been actively interested in the electric smelting process for some years past, is now forming a company to establish an electric smelting industry at a power site at the Chats, some thirty miles west of Ottawa, on the Ottawa River.

## Gas Notes.

The Maple Leaf Flour Mills, Brandon, are installing a 375 h.p. producer gas engine at a cost of $20,000.

## Trade Notes.

The Curtis & Curtis Co., of Bridgeport, Conn., manufacturers of the Forbes Patent Die Stock report a decided improvement in business and running its plant at full capacity in all departments. This company report recent sales of two of the largest machines of their manufacture ranging from 4-15" to the Davis Coal & Coke Co., Thomas, W. Va., and Atlantic City Electric Co., Atlantic City, N. J., also large orders for export.

As a result of the recent disastrous conflagration at the Ontario Parliament buildings, H. F. Strickland, Chief Electrical Inspector for the Canadian Board of Fire Underwriters' Association, has recommended to the Hon. Dr. Reaume, Minister of Public Works, that a Bridge Megger test be made every day for the purpose of ascertaining if the circuits are in good order. Mr. Strickland is thus enforcing the practice which is common to European countries where losses by fire are exceptionally low. Vandeleur and Nichols supplied the Bridge Megger for the Public Works Department and we understand it has given good satisfaction.

# Power Supply Markets

## MONTREAL.

The demand for specialties continues active, especially for those that reduce fuel costs. The question of decreased coal consumption is attracting considerable attention owing to the anthracite coal producers in the United States endeavoring to market their culm. They are doing this by selling small sized anthracite coal at very low prices to stimulate consumption, and as these fuels can only be burned successfully with forced draft (usually combined with a steam jet) and on a different type of grate to that used for run of mine bituminous, there is a steady inquiry for such specialties that are necessary under the conditions. In this connection automatic boiler feed control systems are also receiving no little attention. Economy in the power end of factories is receiving more attention than ever before. This might be said to be due to the fact that the producing ends have had their share of overhauling and standardizing with the view of economy, while the power or non productive end has received only passing attention. That this attention has grown of late is amply demonstrated in the increasing number of orders for specialties and power cost reducers.

Among the recent purchasers of power equipment appear frequently the names of many of the growing western municipalities, that are putting up light and power plants. The Robb Engineering Co. have under way a 21" & 39" x 24" vertical cross compound Robb-Armstrong Corliss engine for Saskatoon. This will be direct connected to a 500 k.w. Allis-Chalmers-Bullock generator. Claresholm, Alberta, and Ladysmith, B.C., have each ordered a 13" & 26" x 14" tandem compound Robb-Armstrong engines for direct connection to 150 k.w. generators. Kamloops, B.C., are getting a 16" tandem compound Robb-Armstrong for direct connection to a 200 k.w. Westinghouse generator. The Canadian Fairbanks Co. have recently ordered 4—72" x 18' boilers from the Amherst firm to be sent to B.C. Of the inquiries coming into Montreal a large proportion are from Winnipeg and the west and these are expected to be productive of orders which will increase after the crop has moved.

The Jas. A. Ogilvy & Sons Co., have called for tenders for the equipment of the power plant in their new store now building. It is their intention to make the plant a point of interest to visitors and customers and a gallery is to be run around the installation. The engines and equipment are all to be painted with a white enamel paint which, if kept bright, will certainly present a very attractive appearance.

Peiler & McKenzie have received the contract to supply the Mount Royal Spinning Co., with a complete Bundy return trap system to take care of the condensation on the bleaching and finishing systems. The installation is being made according to plans prepared by the American Radiator Co. (Bundy dept.) Bundy traps have also been specified for the new power plant of McGill University. During the past few weeks Peiler & McKenzie have placed 9 Berry feed water heaters.

The J. Eveleigh & Co., makers of trunks and bags are building a new factory, the power plant equipment of which will include two Goldie-McCulloch return tubular boilers, 66"x 16'—0". A feature of this installation is the use of the patented shaving box by which the shavings are automatically fed to the fires. Two 11"x12" Robb-Armstrong automatic engines belted to the line shafting supply the power.

BOILER TUBES :—There is a decided betterment in the market for boiler tubes. Orders are coming in on a larger basis with more substantial appearance and the whole tenor of the market is firm and strong. The mills supplying this district seem to be very busy if one may judge from the way deliveries are reaching out farther into the future. The good showing of the market at this time of the year, when usually it is more or less dull, is very satisfactory. There has been, as yet, no change in prices although it would not be surprising if an advance occurred in the near future. They stand at present as follows :—2-in. tubes (per 100 feet) $8.50 to $8.80; 2½-in., $10.25 to $10.80; 3-in., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

LUBRICATING OILS :—There is no change in the situation in this line. The business doing is of a very fair volume and prices are unchanged as follows :—Cylinder oil, (imp. gal.) 60c. to 80c.; engine oils, 30c. to 60c.; machine and dynamo oils 30c. to 45c.; shafting oils, 25c. to 40c.; lubricating greases (per lb.) 8c. to 12c.

GASOLENE :—This commodity which recently slumped to 17½c. is back again at 18½c. There is a satisfactory amount of orders going but nothing of a very startling nature. Prices are 18½c. per imp. gal. or 15½c. in drums with cases $2.60 f.o.b. Montreal.

MECHANICAL RUBBER GOODS :—It is the first time in the history of the rubber business that conditions have been so unfavorable to the manufacture of mechanical rubber goods. Crude rubber which has been up to the $2.00 mark is still very high at $1.58 (Sept. 1st) and is fluctuating around that point. One reason for the recent drop is seen in the fact that States and elsewhere, scenting an organized attempt to boost prices, have cut down on their demand. Some have actually closed their plants temporarily, devoting their time to overhauling and repairs while waiting for the new rubber crop. There has been no change in the prices of belting and other mechnnical rubber goods since the readjustment of last July although the latest market reports concerning the rubber trade lead to the conclusion that higher prices will most assuredly come. It looks like a period of more or less unrest for the rubber trade emphasized by a fight to establish higher prices, such a fight seeming unavoidable since present conditions leave no other expedient to rubber manufacturers than that of adjusting their prices to the advance in the cost of the crude material, unless they are willing to manufacture at a loss or to make goods of an inferior quality. Even those, who, in the earlier part of the current year were able to fall back on a supply of rubber purchased at lower prices are now facing the question of advanced prices and will be forced to an advance themselves as there seems to be no hope of seeing the market decline much further. Although the price of crude rubber has slumped considerably recently it will no doubt stop a higher mark than that of the preceeding drop. This has always been the case and the normal price of rubber seems twice as high as fifteen or twenty years ago despite the greatly increased production. In view of all this an increase of from 10 to 20 p.c. in the prices of mechanical rubber goods would not be surprising, in fact it seems to be well warranted.

## TORONTO.

A few issues ago reference was made to the growth of the boiler business. This continues to grow and during the present week one firm reports over $50,000 from British Columbia. This is entirely separate from Ontario orders. One traveler alone, showed orders for nearly $10,000 for new boilers in the vicinity of Toronto. Some of these are to replace old installations. Proprietors are beginning to realize that greater economies can be secured in the power plant if it is given the proper attention.

Trade generally has settled down to a steady demand, having shaken off the "fits and starts" variety which characterized the market for some time in the early part of the year.

The activity in leather belting is pronounced and while there have been no advances as yet, it is certain that the higher prices of raw material will force the manufacturers to increase the price as soon as orders for new stocks are made. With the present activity in this line an advance will probably result in the near future.

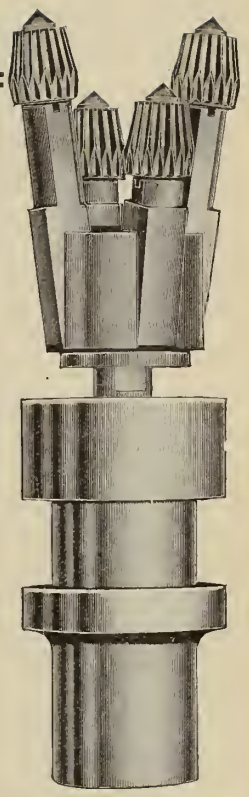
A general advance has been made in rubber goods. The British, United States and Canadian manufacturers are paying a high price for their raw products and the rise has been expected, rubber belting, gaskets, packing, etc., being among the things affected. In connection with this it will be interesting to note the

1. The "LIBERTY" Turbine Tube Cleaner

# Safeguard Your Interests

There isn't a Power Plant in existence that cannot reduce expenses and improve existing conditions by installing one or more of the **"LIBERTY"** specialties. It is the soundest commercial wisdom to instal accessories such as these, for they pay for their cost several times over before they have been installed many months.

Here are brief descriptions of four **"LIBERTY"** specialties:—

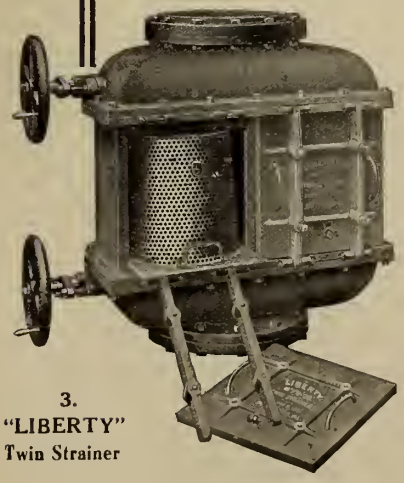


2. The "LIBERTY" CYCLONE Tube Cleaner

*No. 1*—We were first in the field over 12 years ago with a succesful tube-cleaning machine, and we have been improving on it ever since. The **"LIBERTY" Turbine Tube Cleaner** is superior to everything else in design, durability and economy of operation.

*No. 2*—A more powerful tool than the Turbine Tube Cleaner. It is used with compressed air or steam, and is equipped with the **NORIVET** head. It will remove the heaviest scale in record time.

*No. 3*—There is no delay in the running of your plant to scrape out pumps, valves or condensers if you install the **"LIBERTY" Twin Strainer.** One strainer at a time may be removed for cleaning, the water meanwhile flowing through the other.



3. "LIBERTY" Twin Strainer

*No. 4.*—**"LIBERTY" Oil Separator.** Removes all oil from steam. A perfect appliance. Write for complete catalog.

4. Oil Separator

## THE LIBERTY MFG. CO.

**6902 Susquehanna Street, PITTSBURG, Pa.**

# ELECTRIC BARGAINS

**We have some GOOD, PRACTICALLY NEW, MOTORS GOING AT A SACRIFICE**

We manufacture alternating and direct current motors in all sizes also sell Century single phase motors in all their sizes. Repairs promptly and cheaply performed.

**JONES & MOORE ELECTRIC CO., Limited**

294-300 Adelaide St. West Toronto, Ont.

OFFICE FIXTURES, Partitions and Show Cases. Send for illustrated catalogue. Jones Bros. & Co. Limited, 30 and 32 Adelaide W., Toronto, Ont.

THOUSANDS OF DOLLARS go astray in the mails every year. YOU should therefore insure against possible loss by sending YOUR remittances by Dominion Express Company money orders and Foreign Drafts. If delayed, lost or stolen, a refund will be promptly arranged or a new money order issued without further charge. The Dominion Express Company also transfers money by telegraph and cable, and buys and sells Foreign money. If you want to send money to any part of the world the Dominion Express Company will be pleased to accommodate you. Hundreds of agencies throughout Canada.

TAYLOR-FORBES COMPANY, LIMITED. Head Office, Works and Foundries, Guelph. Largest manufacturers of hardware in Canada. (tf)

CASH AND PACKAGE CARRIERS, 20 years' experience inventing and building modern store service appliances. Our guarantee.—We will instal a system of our Carriers in your store; you use them ten days, and if you do not find that they give you better and quicker service than any other Wire Carriers, Pneumatic Tubes, Cable Carriers, or Cash Registers, we will remove them at our expense. Write for catalogue and testimonials from reliable houses using our Carriers. The Gipe Carrier Co., 99 Ontario St., Toronto, Canada. (tf)

YOUR CHEQUE CAN'T BE RAISED to any amount above that which you intend it to cover if you use the PROTECTOGRAPH. This device stamps a line such as "Not over ten dollars, $10," with acid proof, indelible ink, which penetrates right through the fibre of the paper. This device is being used by 90% of the Banks of Canada and the United States, as well as the treasuries of both countries. Write for full particulars and price. W. E. Parker & Co., Sole Canadian Agents, 37 Yonge Arcade, Toronto, Ontario.

WE HAVE eight rebuilt Visible Oliver Typewriters for sale. The price is $30.00 each, and at that figure they are a bargain and should not be on the market long. Monthly payments can be arranged if desired. The Monarch Typewriter Company Limited, 98 King W., Toronto.

PEERLESS CARBON PAPERS and TYPEWRITER RIBBONS are unequalled in writing, manifolding and wearing qualities. Our "Klear Kopy" Carbon was awarded a contract over 43 competing lines by one of the world's largest governments. All up-to-date dealers in stationery, typewriters and office supplies handle our goods. Ask them or write us direct for prices and samples. Peeless Carbon & Ribbon Manufacturing Co., Toronto, Canada.

WANTED—A splendid opportunity for dealers to handle the best combination Duplicating, Addressing and Office Printing Machine on the market. Exclusive territory. Send name and address, giving occupation and references, to the Canadian Writerpress Company, Ltd., 33 John St., Hamilton, Ont. (tf)

ELLIOTT-FISHER STANDARD Writing-Adding Machines make toil easier. Elliott Fisher Limited, 513, No. 83, Craig Street W., Montreal, and 129 Bay Street, Toronto.

ACCURATE COST KEEPING IS EASY If you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe's time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited. Office and factory, 27 Alice Street, Toronto. (tf)


prices of the last ten years as shown by the following table:

| Year | High | Low | Year | High | Low |
|---|---|---|---|---|---|
| 1909 | 1.96 | 1.10 | 1902 | .91 | .70 |
| 1908 | 1.24 | .67 | 1901 | .97 | .83 |
| 1907 | 1.24 | .82 | 1900 | 1.19 | .89 |
| 1906 | 1.29 | 1.22 | 1899 | 1.07 | .96 |
| 1905 | 1.36 | 1.18 | 1898 | 1.06 | .84 |
| 1904 | 1.31 | .94 | 1897 | .88 | .82 |
| 1903 | 1.10 | .86 | | | |

From the high-record quotation of $1.96 per pound shown in the table, fine Para rubber has tumbled 18 points to $1.78 per pound, with scarcely any business at the low figure. In other words, the crude rubber trade, which this year has enjoyed the biggest boom in its history, has developed considerable weakness. The high point of $1.96 made a short time ago was by far the highest price ever established for crude rubber in the annals of the trade.

It is the general opinion that the larger part of the visible supply was at the end of June in the hands of some three or four firms, and until they disposed of their holdings prices continued to go higher. Every effort has been made to rush forward the coming crop for obvious reasons, and the market quotations are interesting.

The price of Para rubber at $1.78 is probably stationary though a further slight reduction will not be unexpected. The rise in price of rubber products in Great Britain and United States is from 20 to 25 per cent. While the higher prices are partially due to manipulation, another reason is that suggested above, the scarcity of Para rubber and the increased demand.

Nine-tenths of the rubber used in the world is found in the forests of Brazil. As it becomes necessary to penetrate further into the interior, the cost of transporting the product to the coast is increased. New plantations are not available for supply until about five years

There is a likelihood of there being a stiffening of prices in the cotton belt market due to increased demand for cotton and rubber duck for automobile tires. The number of automobiles in use this year is about 184,000 in America alone, with an output for this year of 82,000. This number will probably be doubled next year. Plantations are having difficulty keeping pace with the demand and a rise in price of cotton goods is the result.

BOILER TUBES—Orders are good. Lap welded steel per 100 ft., 2-inch, $8.50 to $8.75; 2¼-inch, $10 to $10.75; 2½ inch, $10.75 3-inch $12; 3½-inch, $15, and 4-inch, $18.50 to $19.

BELTING—Orders are good. Prices of leather belting are stationary but a rise in rubber belting is expected immediately.

LEAD WOOL—Demand good. Price stationary at $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35; American, $27.50 to $35 per 1,000.

## CATALOGUES.

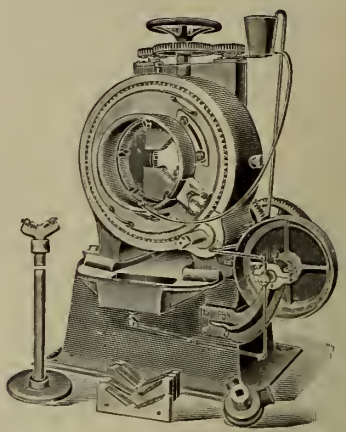
TRANSFORMERS—Circular 1079 from Canadian Westinghouse, Hamilton, Ont., illustrating and describing fully oil-insulated, water cooled transformers. Among the illustrations is a view of 2000 kv-a, 50,000-volt transformers at Shawinigan Water & Power Co., Shawinigan Falls, Quebec.

FIREBRICK—The annual 1909 catalogue of Harbison Walker, Pittsburg, Pa., is a handsome volume, pocket size, bound in leather and complete in every dteail. Their lines of firebriek in various sizes are illustrated and listed, showing their application to various cupolas and furnaces. Some very useful information is included in the volume, making it a valuable one.


SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling, and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD

*The*
# Forbes Patent Die Stock

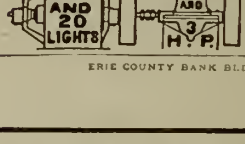


Simple in construction.
Fewer moving parts.
No unnecessary changes.
Requires less power.

*Write*

**THE CURTIS & CURTIS CO.**
26 Garden Street,
BRIDGEPORT, CONN., U. S. A.

DYNAMO-ENGINE-SETS
FUEL - OIL - GASOLENE - ALCOHOL




THE BUFFALO MECHANICAL AND ELECTRICAL LABORATORY.

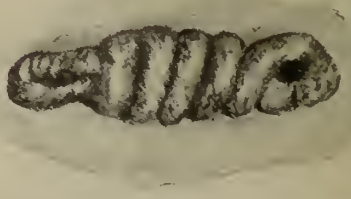
ERIE COUNTY BANK BLDG., BUFFALO, N. Y., U. S. A.

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.

"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

# Chapman & Walker

Limited

Cor. Victoria and Lombard Sts.,

TORONTO

SOLE CANADIAN AGENTS FOR

Crossley Gas Engines

Dick, Kerr Electrical Generators and Motors

Henley Cables

Pritchetts & Gold Storage Batteries

Nalder & Thompson Instruments

"Z" Tungsten Lamps

OUR BUSINESS IS

1.—To contract for complete Gas and Electric, Power and Lighting Systems.

2.—To supply Electrical Accessories at reasonable prices.

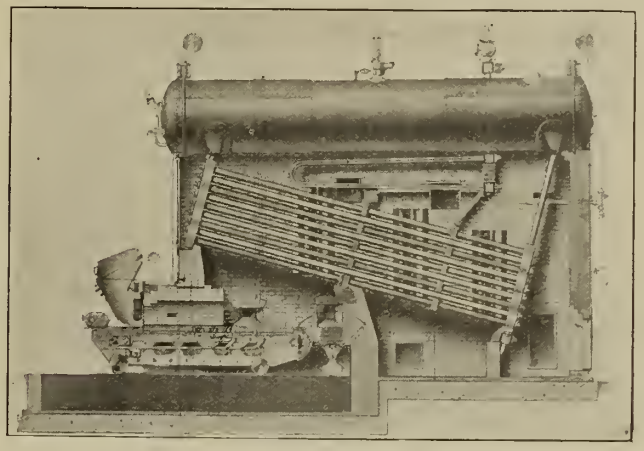
OUR QUALITY is unquestionable.
OUR PRICES pleasing.
OUR DELIVERIES dependable.
OUR CUSTOMERS cared for.

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST EOCNOMY, SAFETY, DURABILITY OVER 7,000,000 H.P. IN USE



Babcock & Wilcox Patent Water-Tube Boiler, Superheater, and Mechanical Stoker

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and ELECTRIC CRANES

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING



# STEAM EQUIPMENT

### Horizontal Boilers

1 refitted 60"x17'6" with 54—4" tubes.
1 new 60"x16' with 44—4" tubes.
1 refitted 60"x13'8" with 78—3" tubes
1 refitted 54"x14' with 70—3" tubes.
1 refitted 60"x13'6" with 72—3" tubes.
1 refitted 60"x12' with 70—3" tubes.
1 refitted 50"x14' with 64—3" tubes.
1 refitted 50"x14' with 60—3" tubes.
1 refitted 56"x12' with 60—3" tubes.
1 refitted 52"x11' with 68—3" tubes.
1 refitted 48"x15' with 54—3" tubes.
1 refitted 48"x13'6" with 44—3" tubes
1 refitted 48"x12' with 52—3" tubes.
1 refitted 44"x11'9" with 42—3" tubes
1 refitted 44"x13'2" with 48—3" tubes
1 refitted 44"x11'3" with 36—3" tubes
1 refitted 44"x11'6" with 43—3" tubes
1 refitted 40"x13'4" with 36—3" tubes.
1 refitted 40"x12' with 32—3" tubes.
1 refitted 38"x15' with 34—3" tubes.
1 refitted 46"x11'5" with 40—3" tubes
1 refitted 38"x13'2" with 33—3" tubes
1 refitted 38"x12' with 26—3" tubes.
1 refitted 38"x11' with 28—3" tubes.
1 refitted 32"x11' with 23—3" tubes.
1 refitted 34"x7'2" with 40—2" tubes.
1 refitted 43"x49" with 60—2½" tubes
1 refitted 30"x8' with 16—3" tubes.
1 refitted 15"x30" with 4—3" and 9—2" tubes.
1 refitted 15½"x27" with 21—2" tubes.

### Fire-Box Boilers

1 refitted 48"x20' with 52—3" tubes.
1 nearly new 44"x18' with 46—3" tubes
1 refitted 36"x13'10" with 36—3" tubes
1 refitted 36"x13' with 44—2½" tubes.
1 refitted 36"x12'10" with 43—2½" tubes.

### Vertical Boilers

1 refitted 48"x10'6" with 152—2" tubes.
1 new 42"x87" with 92—2" tubes.
2 new 36"x96" with 68—2" tubes.
2 new 36"x96" with 55—2" tubes.
2 new 36"x78" with 68—2" tubes.
1 refitted 36"x87" with 78—2" tubes.
1 new 36"x84" with 55—2" tubes.
1 refitted 40"x65" with 137—1½" tubes.
1 new 36"x72" with 55—2" tubes.
1 refitted 30"x72" with 55—2" tubes.
2 refitted 30"x60" with 43—2" tubes.
1 refitted 30"x62" with 50—2" tubes.
1 new 26"x60" with 37—2" tubes.
1 new 24"x60" with 31—2" tubes.
1 refitted 26"x48" with 37—2" tubes.
1 new 24"x50" with 31—2" tubes.
1 refitted 25"x43" with 61—1½" tubes
1 refitted 22"x50" with 22—2" tubes.
1 new 20"x43" with 19—2" tubes.
2 new 20"x36" with 16—2" tubes.
1 refitted 19"x37" with 14—2" tubes.
50 new 19"x44" with 13—2" tubes.

### Automatic Engines

2 refitted 12"x12" Robb-Armstrong
1 refitted 9"&16"x12" Ball tandem.
1 refitted 12"x30" Corliss.
1 refitted 12"x28" Corliss.
1 refitted 12"x10" Westinghouse jr.
1 refitted 10"x10" Leonard Peerless
1 new 10"x15" Jewel.
1 refitted 9½"&14½"x12" tandem.
1 refitted 8"&13"x18" tandem.
1 refitted 10"x24" Brown.
1 refitted 9"x24" Wheelock.
1 refitted 8"x24" Wheelock.
1 refitted 8"x24" Brown.
1 refitted 7"x10" Leonard-Ball.
1 refitted 6½"x9" Armington & Sims.

### Vertical Engines

1 refitted 16"x16" slide valve.
2 new 7½"x10" Dutton slide valve.
2 new 7½"x9" Dutton slide valve.
1 new 7½"x8" Dutton slide valve.
1 refitted 7"x8" Troy slide valve.
2 refitted 6½"x8" Doty slide valve.
1 refitted 6"x8" piston slide valve.
2 new 6"x7½" Dutton slide valve.
1 new 5"x5" Amerlean high speed.
1 refitted 5"x7½" Dutton slide valve.
1 new 4½"x5" Dutton slide valve.
1 refitted 3½"x5" Dutton slide valve.

### Horizontal Engines

1 refitted 16"x24" rocking valve.
1 refitted 11½"x14" slide valve.
1 new 12"x15" slide valve.
1 nearly new 12"x12" slide valve.
1 new 11"x15" slide valve.
1 refitted 10½"x16" slide valve.
1 new 10"x15" slide valve.
1 new 10"x12" slide valve.
1 refitted 8½"x9" slide valve.
2 refitted 8"x10" slide valve.
1 refitted 8"x13" slide valve.
1 refitted 8"x12" rocking valve.
1 refitted 7"x10" slide valve.
1 refitted 8"x8" slide valve.
1 refitted 7"x12" rocking valve.
2 refitted 7"x12" slide valve.
1 refitted 6"x9" slide valve.
2 refitted 5"x6" slide valve.
1 refitted 5"x7" slide valve.

### Marine Engines

1 new 12"& 23"x18" steeple compound.
2 new 7"& 11"x10" F. & A. compound.
1 new 9"x12" slide valve.
1 refitted 9"x12" Doty slide valve
2 new 6"x7½" slide valve.
1 refitted 6"x6" slide valve.
1 refitted 4"x4" double cylinder.
1 refitted 4"x5" slide valve.

*OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST*

# H. W. PETRIE, Ltd.,

Toronto,
Montreal,
Vancouver

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. D. McArthur, Brockville
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

W. H. Adams, 102 Nazareth St., Montreal, Que.
Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Hygienic Laboratories, Toronto
Nichols Chemical Co., Montreal
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto
Michigan Lubricator Co., Detroit
Morehead Mfg. Co., Detroit, Mich.

## Boiler Feed Pumps.

Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Michigan Lubricator Co., Detroit
Wm. B. Pierce Co., Buffalo

## Boilers.

Babcock & Wilcox, Montreal
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldio & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Canners' Machinery.

J. C. Wilson & Co., Glenora, Ont.

## Cars, Transfer.

Corbet Foundry and Machine Co., Owen Sound

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Canada Chemical Mfg. Co., London

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Walter J. Francis, Montreal.
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
Moore & Scollan, Toronto
John B. McRae, Ottawa
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Contractors, Structural Steel

Corbet Foundry and Machine Co., Owen Sound

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenora, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo, N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Mechanical & Elec. Lab., Buffalo
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mass

## Flumes, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peterboro Lubricator Mfg. Co., Peterboro

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

### Lubricators, Force Feed.

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

### Maple Cogs.

J. C. Wilson & Co., Glenora, Ont.

### Mechanical Stokers.

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

### Meters, Water and Electric.

Peiler & MacKenzie, Montreal

### Mill Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg, Co., Lindsay, Ont
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

### Mining Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

### Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

### Oilers, Gang.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

### Oil Filters

Darling Bros., Montreal

### Oil Separators.

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Oils, Lubricating.

The "Skaleoff" Co., Montreal, Que.

### Packing Leather.

Detroit Leather Specialty Co., Detroit

### Packing, Metallic.

Rhodes Improved Metallic Packing Co. Montreal

### Panels, Electric

Hill Electric Switch Co., Montreal

### Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pipe Cutting and Threading Machines.

Curtis & Curtis Co., Bridgeport, Conn.

### Pipe Threading Tools.

Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

### Piping, Steam,

Babcock & Wilcox, Montreal

### Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

### Polish, Metal,

G. W. Hoffman, Indianapolis

### Power Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

### Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

### Processing Retorts.

J. C. Wilson & Co., Glenora, Ont.

### Pulleys, Iron.

J. C. Wilson & Co., Glenora, Ont.

### Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

### Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

### Pump Strainers.

Canadian Steam Boiler Equipment Co., Toronto

### Pumps, Air,

Lunkenheimer Co., Cincinnati, Ohio

### Pumps, Oil.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

### Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

### Safes.

Goldie & McCulloch Co., Galt.

### Safety valves.

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

### Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,
J. C. Wilson & Co., Glenora, Ont.

### Shaking and Dumping Grate

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

### Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto
The "Skaleoff" Co., Montreal, Que.

### Smoke Stacks.

Babcock & Wilcox, Montreal
Corbet Foundry and Machine Co., Owen Sound

### Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

### Sprocket Wheels.

J. C. Wilson & Co., Glenora, Ont.

### Spur Wheels.

J. C. Wilson & Co., Glenora, Ont.

### Steam Pumps.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

### Steam Separator.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto

### Steam Specialties.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

### Steam Traps.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Morehead Mfg. Co., Detroit, Mich.
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

### Stokers.

Erie Foundry Co., Erie, Pa.

### Switches, Electric

Hill Electric Switch Co., Montreal

### Superheaters, Steam,

Babcock & Wilcox, Montreal

### Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co., Montreal

### Tanks, Blow-off

Darling Bros., Montreal

### Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Shorbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

### Tanks, Steel.

Corbet Foundry and Machine Co., Owen Sound

### Tests and Inspections.

Bain & Mitchell, Montreal

### Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal

### Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

### Trucks, Dry Kiln.

Corbet Foundry and Machine Co., Owen Sound, Ont.

### Trucks, Factory.

Corbet Foundry and Machine Co., Owen Sound

### Tubes, Boiler,

Babcock & Wilcox, Montreal

### Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd, Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

### Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

### Unions

Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit

### Vacuum Drying and Impregnating Apparatus.

J. P. Devine Co., Buffalo, N.Y.

### Vacuum Governors.

Canadian Steam Boiler Equipment Co. Toronto

### Vacuum Pans.

J. P. Devine Co., Buffalo, N.Y.

### Vacuum Pumps.

Canadian Steam Boiler Equipment Co., Toronto
J. P. Devine Co., Buffalo, N.Y.

### Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

### Vacuum Traps.

Morehead Mfg. Co., Detroit, Mich.

### Valve Reseating Machines

Darling Bros., Montreal

### Valves.

Canadian Steam Boiler Equipment Co., Toronto
Jenkins Bros., Montreal
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Standard Engineering Co., Toronto.

### Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

### Water Purifiers.

Babcock & Wilcox, Montreal

### Water Softeners.

Babcock & Wilcox, Montreal

### Watt Meters.

Gas & Electric Power Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Allis-Chalmers-Bullock ..... inside front cover

**B**

Babcock & Wilcox ..... 52
Beaubien, De Gaspe ..... 58
Brownell Co ..... 3
Buffalo Mechanical and Elec. Lab ..... 50
Butterworth Foundry Co ..... 5

**C**

Canada Gas Power & Fuel Co ..... 62
Canada Metal Co ..... 64
Canadian Assn. Stationary Engineers ..... 63
Canadian Steam Boiler Equipment Co ..... 5
Chapman & Walker, Limited ..... 51
Corbet Boiler & Machine Co ..... 56
Curtis & Curtis ..... 59

**D**

Darling Bros ..... 9
Dart Union Co ..... 6
Death & Watson ..... 58
Detroit Leather Specialty Co ..... 12
Devine, J. P., Co ..... 59
Diamond Grate Bar Co ..... 4
Dietrich, W. N ..... 58
Dominion Belting Co ..... 10
Dominion Electric Co ..... 13
Dymond Gas and Engine Co ..... 56

**E**

Electrical Maintenance & Repair Co inside back cover
Erie Foundry Co ..... 60

**F**

Farmer, John T ..... 58
Featherstonhaugh ..... 58
Francis, Walter J ..... 58

**G**

Galt & Smith ..... 58
Garde, John, & Co ..... 50
Goldie & McCulloch Co ..... 16
Goodhue, J. L., & Co ..... 10
Goold, Shapley & Muir ..... 61

**H**

Hercules Float Works ..... 58
Hill Electric Switch Co ..... 10
Hoffman, G. W ..... 50
Hygienic Laboratories ..... 14

**I**

Ideal Steam Separator & Supply Co ..... 6

**J**

Jenckes Machine Co ..... 3
Jenkins Bros ..... 55
Johnson, F. M. G ..... 58
Jones & Moore Electric Co ..... 50
Jones Underfeed Stoker Co ..... 63

**K**

Kerr Engine Co ..... 8
Kilmer, Pullen & Burnham ..... inside back cover

**L**

Leonard, E., & Sons ..... 3
Liberty Mfg. Co ..... 49
Lunkenheimer Co ..... 8

**Mc**

McArthur, J. D ..... 13
McGhie, W. C ..... 56
McLaren, D. K., Ltd ..... 11
McLeod & Henry Co ..... 64
McRae, J. B ..... 58

**M**

Merrill, Edward B ..... 58
Michigan Lubricator Co ..... 62
Mitchell, C. H. & P. H ..... 58
Moore & Scollan ..... 58
Morehead Mfg. Co ..... 9
Morrison Brass Mfg. Co., Ltd., Jas outside back cover

**N**

Nichols Chemical Co ..... 7
Northern Electric and Mfg. Co ..... 15

**P**

Packard Electric Co., Ltd ..... 59
Peiler & MacKenzie ..... 8
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 52
Pierce, Wm. B ..... 7
Plomo Specialty Mfg. Co ..... 10
Polson Iron Works ..... 2

**R**

Rhodes Improved Metallic Packing Co ..... 56
Robb Engineering Co ..... 12
Robertson, J. M ..... 58
Russell & Gifford ..... 9

**S**

Sadler & Haworth ..... 13
Sammett, M. A ..... 58
Shanly, J. M ..... 58
Sight Feed Oil Pump Co ..... 6
Skalcoff Co ..... 7
Snowdon, S. S ..... 61
Standard Engineering Co ..... 9
Sterling Electric Supply Co ..... 1

**T**

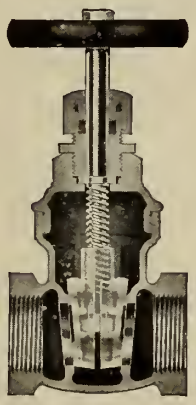
Technical Books ..... 62
Turbo-Blower Co ..... 9

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 61
Wilson, J. C., & Co ..... 58

A NEW VALVE

# JENKINS BROS.'



GUN METAL AND IRON BODY

## GATE VALVES

"TYPE K"

*Special Features:*

Highest Quality Steam Metal.
Perfect Interchangeability.
Double Compensating Bronze Wedges.
Metal Gland in Stuffing-Box.
Great Strength of All Parts.
Carefully tested to 250-lbs. Water Pressure.

UNRIVALLED IN DESIGN and WORKMANSHIP

A THOROUGHLY RELIABLE GATE VALVE
FOR
STEAM, WATER, OIL, GAS OR AIR.

*A trial will convince you that it will pay you to use these valves on all your work.*

STAMPED WITH Trade Mark LIKE CUT

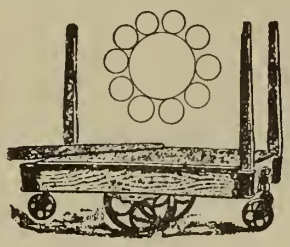
*Stocked by Machinery, Hardware and Supply Dealers throughout the World.*

*Catalogue and Full Particulars Cheerfully Furnished on Application.*

## JENKINS BROS., Limited

And at
95 Queen Victoria Street,
London, E.C.

Head Office and Works:
102 St. Remi Street
Montreal, Canada



Roller Bearing
Factory Trucks

The only ones made in Canada

Dry Kilns Installed

Roller Bearing Dry Kiln Trucks
Roller Bearing Transfer Trucks
Roller Bearing Lumber Trucks

MUNICIPAL STEEL BRIDGES Specifications Solicited . .

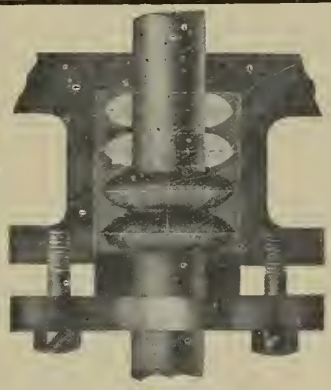
We make any kind of truck to specifications. Heavy duty truck a specialty.
Write for prices to

Corbet Foundry & Machine Co., Owen Sound


## Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over in the Province of Ontario must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act.

W. C. McGHIE,
Chairman of Board
Parliament Buildings, Toronto.

# Absolute Packing Satisfaction

is what we guarantee to users of

## The Rhodes Improved Metallic Packing

It stays packed under the most trying conditions and will not injure any rod

## Especially Adapted for Ammonia

## The Rhodes Improved Metallic Packing Co., Limited

Agents Wanted

11 St. Sacrament Street, Montreal Write to-day for particulars

# The Dymond Gas & Engine Co. LIMITED

131 Queen St. East, TORONTO

MAKERS OF

# GAS PRODUCERS PRESSURE AND SUCTION

FOR ANTHRACITE COAL

## Pressure Bituminous Plants for Large Instalations

# HIGHEST THERMAL EFFICIENCY

AGENTS FOR

The largest makers of gas engines in the world---Vertical and Horizontal, all sizes and types

WILLANS & ROBINSON STEAM TURBINES

All classes of Pumps and Pumping Machinery

If your present power is not satisfactory, advise us and we will help you out and guarantee results

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 11 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisementa must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1¼" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### For Sale

FOR SALE CHEAP FOR CASH—One 15 h.p. horizontal engine, second hand, made by F. Lowe & Sons. Ottawa. Apply to Marshall Rothwell, P.O. Box 1, Navan, Ont. (10)

### For Sale

FOR SALE or will grant exclusive right to manufacture on royalty Canadian Patent 115643 a necessary household article simple to make. Arthur Solomon, 211 Winslow Ave. Buffalo, N.Y. (11)

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour. elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBONTYPE PORTABLE BOILERS 7' each, 60 h.p.

HEINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five years.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12"x12 M'Ewen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumps, second hand. Waterous Engine Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

### For Sale

One Westinghouse Generator, 54 k.w. Direct current, 125 volts, speed 850, complete with switchboard, instruments, etc. Rest of order. Will sell reasonable. Mr. Taber, 444 Bathurst St., Toronto. (8)

### For Sale

Two Fitzgibbon Boilers for sale at a hargain. Are now carrying 70 lb. pressure. Would make splendid heating boilers. G. C. Mooring, 16 Pearl Street, Toronto. (9)

### For Sale

ONE 5 h.p. Cook vertical gasoline engine, double ignition, complete with tank, skids, and all accessories. A new engine at a bargain for quick sale. Kellogg & Co., 196 King St. West, Toronto.

TENDERS will be received by the City of Toronto, Canada, up till noon of THURSDAY, OCTOBER 28th, for the following Electric Motors and Turbine Pumps. For specifications and form of tender apply to the City Engineer.

ELECTRIC MOTORS

4—1500 H. P. Synchronous Motors.
2—1500 H. P. Induction Motors.
4—500 H. P. Synchronous Motors.
4—500 H. P. Induction Motors.
2—225 H. P. Synchronous Motors.
With Exciters, Switchboards, connecting material, etc.

TURBINE PUMPS

4—13½ million gallon pumps, 100 pounds pressure.
2—5 million gallon pumps, 300 pounds pressure.
2—10 million gallon pumps, 65 pounds pressure.
2—10 million gallon pumps, 110 pounds pressure.
2—6½ million gallon pumps, 90 pounds pressure.
2—6½ million gallon pumps, 160 pounds pressure.
2—1½ million gallon pumps, 65 pounds pressure.
2—1½ million gallon pumps, 110 pounds pressure.
With Valves, Piping, Bed-Plates, Coplings, etc. (10)


## SOMETHING THAT WILL INTEREST YOU

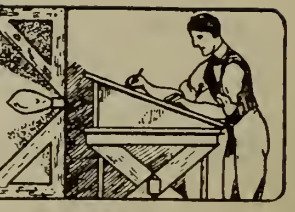
¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

# PROFESSIONAL DIRECTORY




**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**W. N. DIETRICH**
ELECTRICAL AND MECHANICAL ENGINEER
16 St. Sacrament Street, Montreal
CONSULTING AND CONTRACTING
Supervision, Specifications, Plans, Tests, Reports, Etc.

HARRY A. MOORE — JOHN J. SCOLLAN
**MOORE & SCOLLAN**
ELECTRICAL AND MECHANICAL ENGINEERS
STEAM, ELECTRIC AND HYDRAULIC POWER
CONSULTATION, REPORTS, ESTIMATES, PLANS, CONSTRUCTION, TESTING, ETC.
OFFICES: GUARANTEE BLDG., 43 KING ST. W.
TELEPHONE MAIN 445 — TORONTO, CAN.

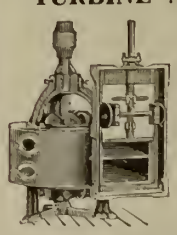
**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 2716

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**Consulting and Supervising Engineers**
You should have your card appear regularly on this page—you may miss important engagements by not being represented.

**HERCULES Seamless Copper FLOATS**
**Are Absolutely Reliable**

We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request,
**Hercules Float Works**
P.O. Box 396. — Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**

Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest efficiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty

THE

## Emil Passburg System

### Vacuum Drying and Impregnating

Drys and Impregnates electric cables, dynamo and motor armatures, field and magnet coils, etc. Impregnating compound enters the vacuum chamber without breaking the vacuum, thus eliminating the possibility of the dried coils re-absorbing moisture. The most economical and satisfactory Drying and Impregnating process known to science.

*All sizes and types. Write us for complete catalog*

J. P. DEVINE CO.
BUFFALO

LUFKIN **MACHINE DIVIDED RULES**
**ARE STANDARDS OF ACCURACY AND MATERIAL**

Our catalog tells about their many superior features.
It's sent free on request.

THE LUFKIN RULE CO. OF CANADA, LTD.
WINDSOR, ONT.

# THE WATER TEST

Packard

## Type "D" Motor

Reproduction from an actual photograph, showing the "Water Test" as applied to a Packard Type "D" Motor.

shown in the picture, proves one of the many points about the PACKARD Type "D" Motors, that combines to make them peculiarly adaptable for severe operating conditions.

The test consisted of a submersion of the motor in a tank. Connection being made to the circuit, the motor was allowed to run—completely under water—for several hours at a time—and, after repeated tests, the insulation was found to be in no-wise affected.

Could you ask better proof of the **ruggedness of design** and **careful construction** of the motor; or of the success of our Vacuum process of insulation?

## The Packard Electric Co., Limited

Head Office and Works
St. Catharines, Ont.

Branch Offices
Montreal and Winnipeg

ERIE STOKERS AT PLANT OF WEBSTER CITIZENS CO., BUFFALO, N.Y.

This stoker is of the overfeed plunger type and does what the most expert fireman would do, providing he were absolutely tireless, absolutely careful and loyal—and could fire without opening the doors of the furnace.

# Erie Stoker

## Feeds the coal--doesn't burn it

—without opening furnace doors it spreads the coal. Then it is up to the boiler.

And it works for almost nothing.

Being outside the firebox there are almost no repairs to make---and what few there are, can easily be made without stopping the plant and without calling in the aid of a high-priced expert.

**$350.00** *F.O.B., Erie, Pa.*

**Let us send it on sixty days' trial**

Here is an opportunity never offered before. No stoker has ever sold at anywhere near this price. And you can try it out yourself —in your own plant—with the privilege of returning it at our expense for freight, if you think you can get along without it. Investigate this without delay. Sign and mail the coupon at once.

**ERIE FOUNDRY CO.,** ERIE PA., U.S.A.

**Messrs. Scott, Campbell & Co., Toronto, Ont.**
**Agents for Canada**

*Coupón*

Messrs. Scott, Campbell & Co., Toronto, Ont.

I want to know more about the Erie Stoker.

NAME.....

STREET.....

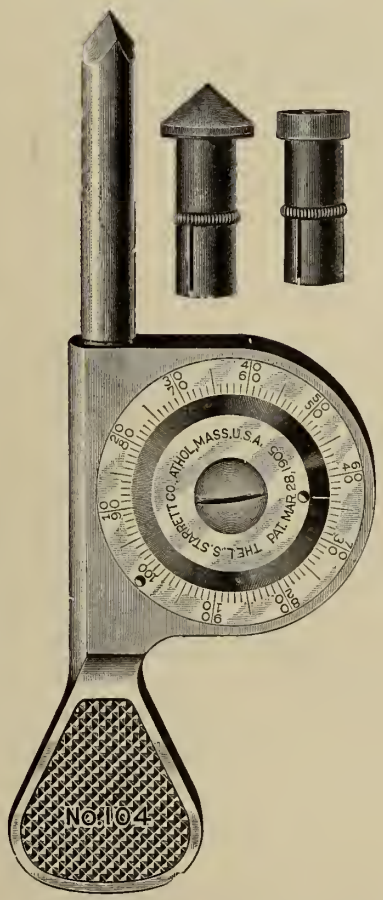
CITY..... PROVINCE.....

NAME OF MY FIRM.....

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE." If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

**PUBLISHED MONTHLY AT $1.00 PER YEAR.**
**Start in TO-DAY to earn one of these handy Tools.**

## THE POWER HOUSE
**10 Front Street East TORONTO**

## IF YOU DESIRE

to keep your boilers from foaming and to save on your fuel bill, use my POTATO SCALE BOILER CLEANSER, which has no effect on boiler pipes, shell, or connections.

Mail me a sample of the water you use, and I will prove to you that I can make good the above statements.

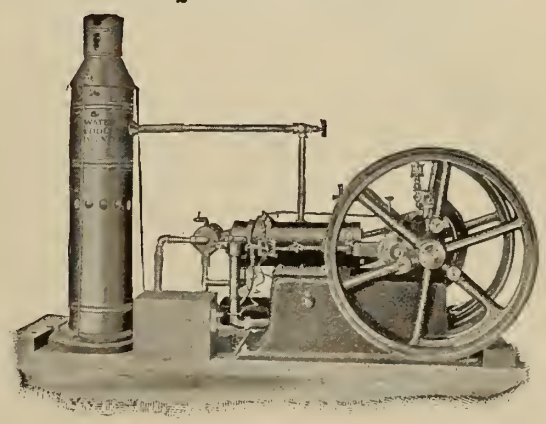
Sole Agent for America:

## C. C. SNOWDON
**Wholesale Oil Merchant** **CALGARY, Alta.**

**Branch Storages at New York and Montreal**



# GAS and GASOLINE ENGINES
## 1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

## Goold, Shapley & Muir Co.
Limited

**BRANTFORD · CANADA**

# 25 Horse Power Gas Engine

used only

# 118 Pounds of Pea Coal per Day

(10 hour day, including 2 hours over-load)

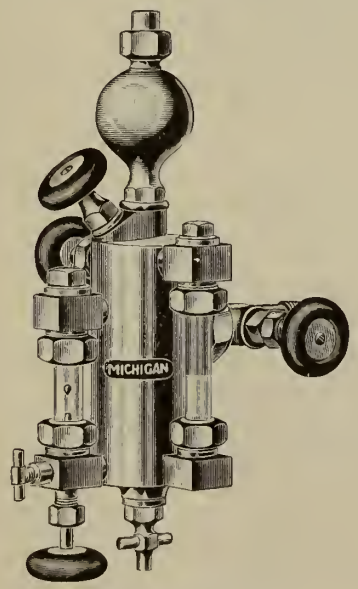
## Can your best showing equal this??

The Plant is The Standard Foundry Co., Longueuil, P.Q.
The Producer is The Dominion Suction Producer.
The Engine is a Tangye Gas Engine.

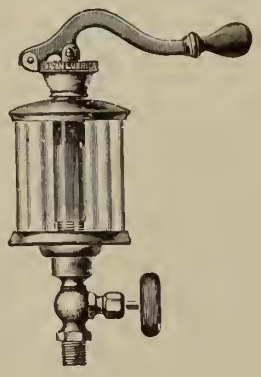
and you can learn more facts about them from

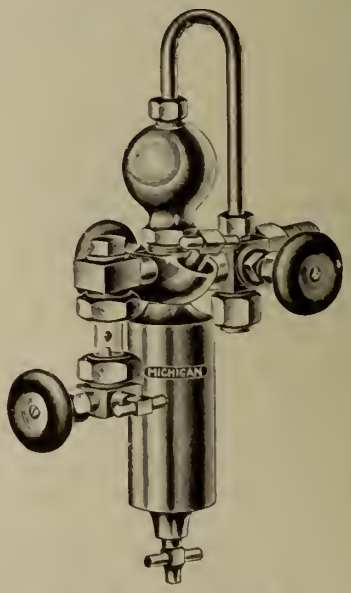
**The Canada Gas Power & Fuel Co., St. 68 James St. Montreal**

# MICHIGAN




Illustrated catalog mailed to you free






Write to-day

## MICHIGAN LUBRICATOR CO.

DETROIT, MICH.

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

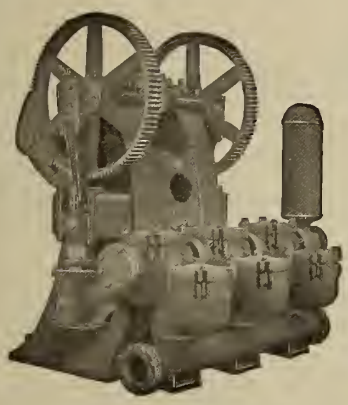
## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA





## On Account

of their

Extremely Low Cost of

Operation and the Small

Amount of Attention

Required

# Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**
Coristine Bldg., Montreal
Phone Main 1054

*Works - - - - - - Seneca Falls, N.Y.*



# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization ?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

NEW YORK CITY BRANCH,
1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS
TROY, N.Y.

# Prevention is Better than Cure

To
Prevent
your
Bearings
Running
Hot

Use
Harris
Heavy
Pressure
Bearing
Metal

Manufactured and Guaranteed by

## The Canada Metal Co., Ltd., Toronto

# IT'S COMING

With the longer nights, comes the steady, full load on your generators and transformers, the load that **hunts out the weak spots.**

## Are You Prepared?

Call at once for the specialists in the care of elecrical diseases to make those repairs or alterations so necessary to the sure and economical operation of your plant.

## The Electrical Maintenance & Repairs Co.

**162 Adelaide Street, West TORONTO**

**Phone Main 3419**

## The General Electric Co. of Sweden

**400 H.P. Slow Speed Generators, installed for the Colonial Portland Cement Co. of Wiarton, Ont.**

Complete equipment for power transmission and lighting—all types and sizes.

## MOTORS AND GENERATORS

of Standard and special designs, in sizes up to 20,000 H.P.

*Write us for quotations and descriptive matter, and list of municipal and private plants installed in Canada.*

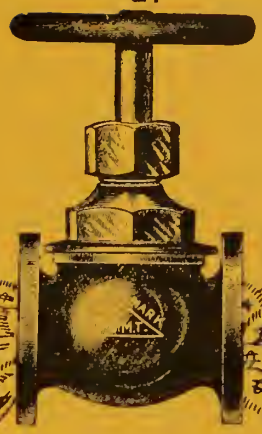
SOLE CANADIAN AGENTS:

## Kilmer, Pullen & Burnham,

505 McKinnon Building, TORONTO

# STEAM GOODS

## OF QUALITY



**MANY A DOLLAR IS SAVED**

by the intelligent buyer of steam valves and other kindred lines for his steam plant.

To save money you require a valve that will be permanently tight—not for a few weeks only.

*TRY*

**J.M.T. Valves**

They have the reputation of combining all that's good in valve construction.

*"THEY LAST"*

Made in J.M.T. standard, also extra heavy.

*TRADE MARK IS ON EVERY VALVE*

All Goods bearing our Trade Mark or Name Stamp are Fully Guaranteed

Perhaps some of these lines may come within your early requirements:

***Iron or Brass Valves***

***Iron or Brass Blow-off Cocks***

***J.M.T. "Y" Blow-off Valve*** *with Renewable Seat*
*It lasts for years without repairs*

***Safety Valves*** *Spring or Weight Adjustment*

***Back Pressure Valves***—
*Standard or Noiseless*

***Relief Valves*** ***Throttle Valves***

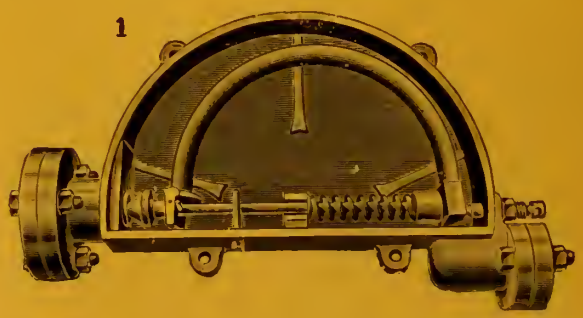
***Reducing Pressure Valves***

***Steam Traps*** ***Exhaust Heads***

***Steam and Oil Separators, etc.***

*We carry Iron or Brass Pipe and Pipe Fittings, Pipe Fitters' Tools, etc.*

1



***The "HEINTZ" Steam Trap***

***Are you looking for a GOOD Steam Trap— One that won't waste steam?***

*Write us about the "HEINTZ"—thousands in use*

---

**The Jas. Morrison Brass Mfg. Co., Ltd.**

**93-97 Adelaide St. West** **TORONTO**

SPECIAL FEATURE—ARTICLES ON FEED WATER

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Ltd.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C.

Vol. II. Publication Office, Toronto—October, 1909 No. 10

TRADE PENBERTHY MARK

AUTOMATIC INJECTORS

Give Your Boiler Room
"A SQUARE DEAL."

Equip it with the best Fittings

Put it next to the best Automatic Injector in the world—

THE GENUINE
PENBERTHY

The Injector that has the best range of feeding qualities, that handles hotter water and works on longer lifts than any other known make, and that

"ALWAYS WORKS."

TRADE PENBERTHY MARK

TO ENGINEERS EVERYWHERE:

We want your name and address to put on our mailing list so that we can send you from time to time special circulars and interesting reading matter. If you will enclose 15c. in stamps or silver, to pay merely cost of postage and packing, we will send you a handsome Penberthy watch fob free. Do it to-day.

AUTOMATIC INJECTORS
SIGHT FEED STEAM LUBRICATORS
STANDARD STEAM WHISTLES
PLAIN ENGINE LUBRICATORS
WATER GAGES
GAGE COCKS
OIL CUPS AND GREASE CUPS
PRIMING CUPS
AIR COCKS, CYLINDER COCKS
RADIATOR AIR VALVES STEAM GAGES
XL-96 EJECTORS SYPHONS ETC.
AUTO-POSITIVE INJECTORS

PENBERTHY INJECTOR CO., Limited, Windsor, Ont.

# Steam Turbines and Electric Generators

IN CAPACITIES FROM 300 K.W. TO 20,000 K.W.

Three 1,000 k.w. Steam Turbines and Generators in the Power House of the Western Canada Cement and Coal Co., Limited, Exshaw, Alta.

## Standard Condensing Turbines

Standard Condensing Steam Turbines, as shown in the above illustration, which receive steam at high boiler pressure and exhaust into vacuum, for ordinary power generation.

## Non-Condensing and Partially Condensing Turbines

Non-Condensing Steam Turbines which receive steam at high boiler pressure and exhaust against atmospheric or higher back pressure, for use where exhaust steam is required for heating or similar purposes.

## Low Pressure Turbines

Low Pressure Steam Turbines which receive the exhaust steam from reciprocating or intermittently operating engines, at about atmospheric pressure, and exhaust into vacuum. These turbines afford the cheapest and simplest means for increasing both the capacity and the efficiency of either condensing or non-condensing engine plants, by converting residual steam energy (heretofore wasted) into useful power.

## ALLIS - CHALMERS - BULLOCK LIMITED

## Works : Montreal

***Sales Offices: MONTREAL, TORONTO, WINNIPEG, VANCOUVER***
***COBALT, CALGARY***

# POWER PLANTS

WE MANUFACTURE

## BOILERS

Return Tubular, Locomotive, Scotch, Upright and Marine.

## ENGINES

McEwen Automatic—Simple or Compound.

## ALL STEAM PLANT ACCESSORIES

Write for Prices and Bulletins

## THE WATEROUS ENGINE WORKS CO., Limited

BRANTFORD - CANADA

Western Branch: Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver

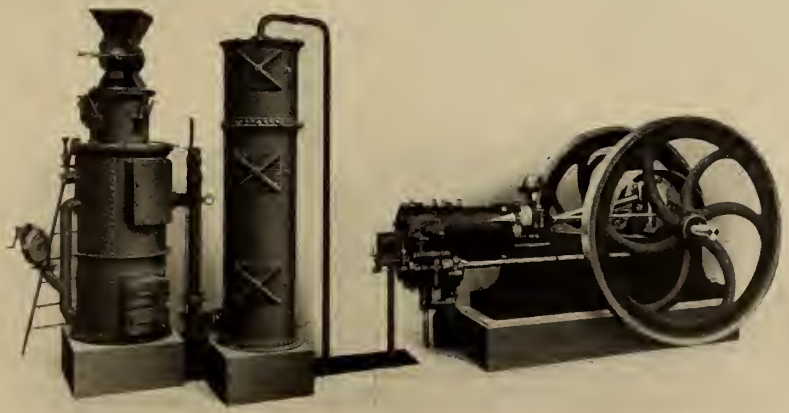
# CHAPMAN & WALKER

LIMITED

CORNER VICTORIA AND LOMBARD STREETS --- TORONTO

## The Crossley Suction Bituminous Producers

Gasify Wood Blocks, Wood Refuse, Sawdust, Peat, Free Burning Coals, Etc.



**Highest Efficiency**

**Lowest Consumption**

WILL RUN CONTINUOUSLY FOR EXTENDED PERIODS

Gas and Oil Engines Representing over 1,200,000 H.P. at work

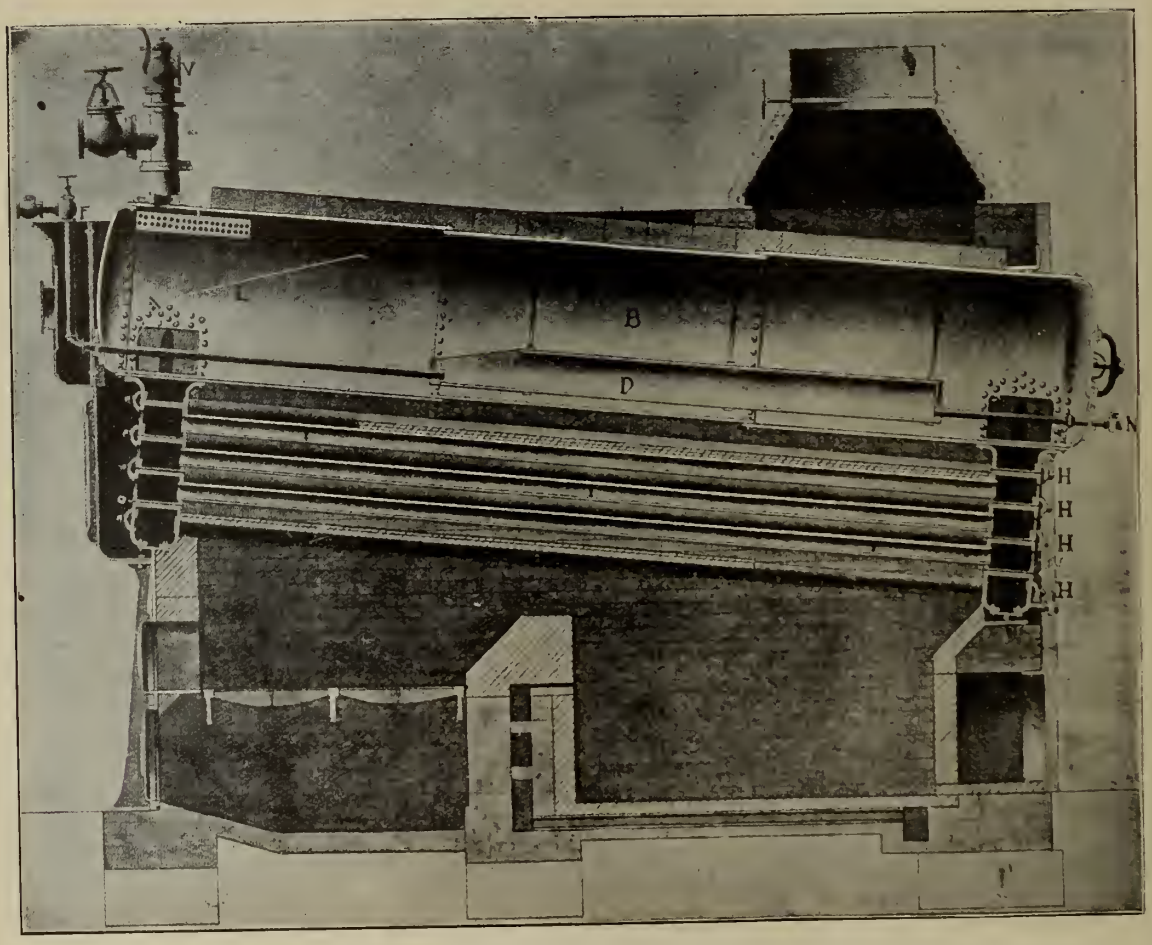
Gas Plants Representing over 200,000 H. P. at work.

WE INVITE YOUR ENQUIRIES—
WE FULFIL YOUR WANTS

# Results Tell the Tale !

No further proof is needed of the undoubted superiority of the

# Heine Safety Boiler




when it is realized how this Boiler is regularly specified by the leading engineers for the largest power plants of the world. Here are a few **Heine** installations selected at random :

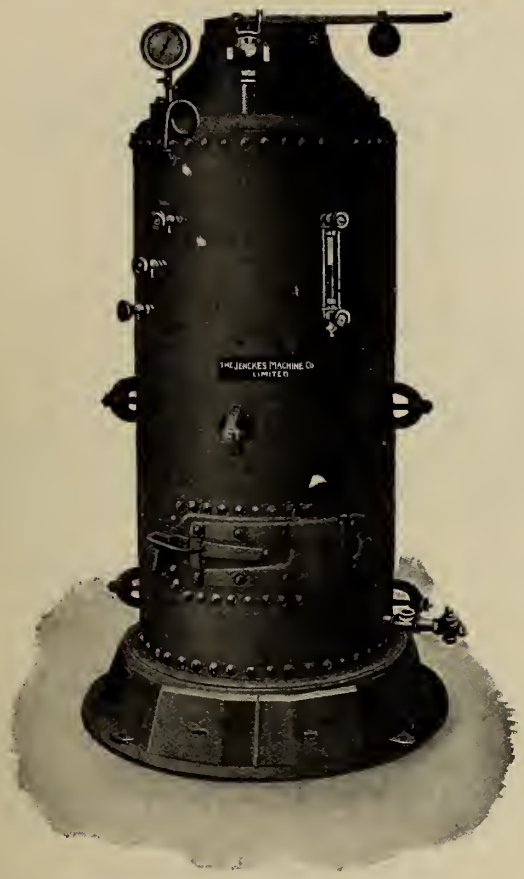
| | | | |
|---|---|---|---|
| T. Eaton Co., Ltd., Toronto | 3250 H.P. | Interco'al Coal M'g Co., Westville, N.S. | 900 H.P. |
| and order now being installed | 1500 " | Winnipeg Street R'y, Winnipeg, Man. | 1500 " |
| T. Eaton Co., Ltd., Winnipeg | 1000 " | N'n'l Portland Ce'nt Co., Durham, Ont. | 900 " |
| Municipal Building, City Hall, Toronto | 550 " | Western Canada Flour Mills, Goderich | 850 " |
| Gutta Percha Rubber Co., Toronto | 1350 " | Harris Abattoir, Toronto, now being installed | 750 " |
| Toronto Electric Light Co., Toronto | 8050 " | High Level Pumping Station, Toronto | 330 " |
| Sunlight Soap Co., Toronto | 500 " | Main Pumping Station, Toronto | 750 " |
| Truth Office, Toronto | 150 " | Now being installed, an additional order | 750 " |
| Foresters' Temple, Toronto | 240 " | F. H. Fleer & Co., Chiclet Mfs., Toronto | 100 " |
| Polson Iron Works, Toronto | 550 " | Now being installed, an additional order | 100 " |
| Pugsley, Dingman & Co., Toronto | 1050 " | Grand Trunk R'y Offices, Montreal | 750 " |
| Confederation Life Building, Toronto | 225 " | La Presse Pub. Co., Montreal | 250 " |
| Home Life Building, Toronto | 100 " | Massey-Harris Co., Toronto | 400 " |
| Quebec Jacques Cartier Elect. Co., Que. | 1400 " | Dredge King Edward, New Westminster, B.C. | 400 " |
| Inverness R'y & Coal Co., Cape Breton | 500 " | Parliament Buildings, New Westminster, B.C. | 300 " |

and hundreds of others.

These installations have proven conclusively that in point of economy and capacity of constant and uninterruped water circulation, and of durability, efficiency and safety, the **Heine Safety Boiler** is the best on the market for every sized plant.

There are numerous points in connection with the **Heine Boiler** which are of vital interest to every Power User and Engineer. As an actual or prospective buyer you are invited to make the fullest enquiries. Our literature will interest you ; send for it to-day.

## Polson Iron Works, Limited - TORONTO CANADA




# VERTICAL BOILERS

¶ For convenience, portability and quick steaming qualities this type of boiler is preferred.

¶ Built in all sizes from 4 to 60 h.p. Larger sizes built to order.

¶ This boiler is deservedly popular and enjoys a large and steadily increasing sale.

*Bulletin No. 103 to any address on request.*

## The Jenckes Machine Company
Limited

**General Offices: Sherbrooke, Que.**

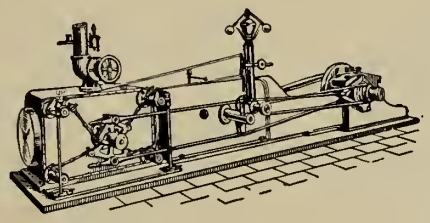
**Works: Sherbrooke, Quebec --- St. Catharines, Ontario**

**Sales Offices:**

**Sherbrooke, St. Catharines, Cobalt, Vancouver, Montreal**

# ENGINES—

**Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper**



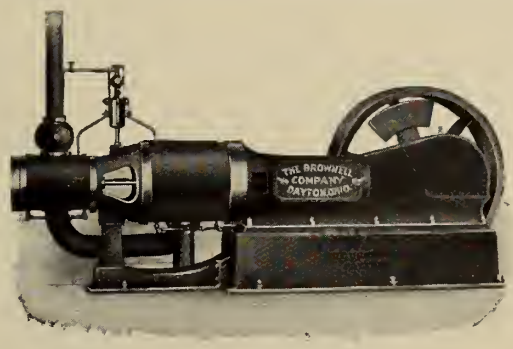
# BOILERS—

**Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.**

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

**LONDON, - ONT.**




## The Brownell Company

**Dayton, - Ohio**

**Branch Offices:**

**401 Bank of Commerce Bldg., St. Louis, Mo.**

**925 Monadnock Bldg., Chicago, Ill.**

**Manufacturers of**

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# NEW MODEL
# DIAMOND SHAKING AND DUMPING
# ——GRATE BAR——

*By using Diamond Grates you increase your power from 5 to 20%*

*The Diamond Grate is applicable to any type of boiler and to units of any size.*

CANADIAN PATENT 118,778

## THE DIAMOND GRATE

## Has no Equal as to Simplicity and Durability

Is specially adapted to cheap fuel, soft and hard coal, screenings and hard or run of mine coal.

TORONTO, Aug. 5th, 1909.

THE DIAMOND GRATE BAR CO.,
119 St. James Chambers, Toronto.

Gentlemen :—The Grate Bars are all you claim for them. The two (2) sets you put in for the Toronto General Hospital are giving perfect satisfaction. They are the most economical bar I have had anything to do with. They are simply perfect. We have had no trouble in burning half and half soft and hard coal screenings, which we could not do before we adopted The Diamond Grate Bar. I can highly recommend the Bar.

With best wishes for your success, I remain, yours truly,

A. E. BENNETT,
Engineer Toronto General Hospital,
Toronto, Ont.

**We make a Specially Heavy Bar for Steamboat and Malleable Annealing Ovens.**

***Boiler Setting and Repairs a Specialty***

***Boiler Tubes, Either Welded or New, at Lowest Price***

*Managers and engineers will save money by consulting us when wanting anything in the boiler line.*

A POST CARD OR PERSONAL INQUIRY WILL BRING A PROMPT REPLY

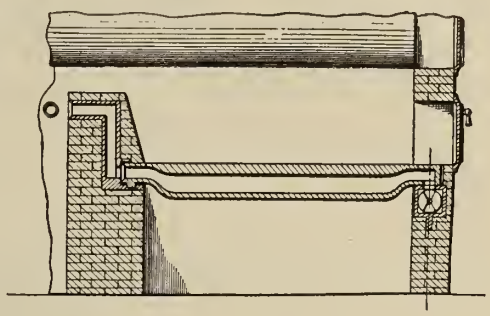
# The DIAMOND GRATE BAR Company

Head Office and Factory, Berlin, Ont.

Branch Office, 119 St. James' Chambers, Toronto. Tel. M 1342

# Satisfied Users

are duplicating their orders for the.....



# FLEMING GRATE BARS

If you are interested in the economy of fuel write

## BUTTERWORTH FOUNDRY, LIMITED

BROAD STREET : OTTAWA, ONTARIO

# "By the way," have you tried our

Harris Heavy Pressure-Bearing Metal?

You will never regret a trial order

Price 22c. per lb.

Manufactured and Guaranteed by

## The Canada Metal Co., Ltd., Toronto

# Test Jenkins '96 Packing

**on any of your worst joints if you want satisfaction.**

***Sold under an Absolute Guarantee.***

***Your money back if it fails to be just what we claim.***

***Jenkins '96*** **is an unvulcanized sheet rubber packing having a flexibility which allows it to bend easily without cracking. It is soft enough to fill any hole or unevenness in the joining surfaces, yet does not blow out though the pressure be immediately turned on. This packing does not need to be watched, as it will not rot nor burn out.**

**Send for our new catalog of valves and packing.**

**JENKINS BROS., Limited - 102 St. Remi St., MONTREAL**

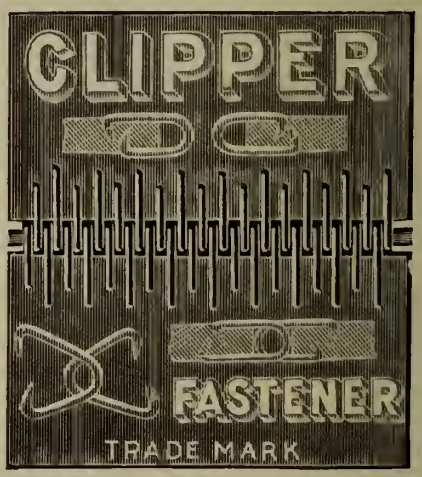
**THE**

# "CLIPPER"
## BELT LACER

Saves time and money, and does the work better than other systems.

*A FEW FEATURES:*

*Laces both sides alike.*
*Same tool laces both single and double belts.*
*Tool holds hook perfectly while inserting it.*
*It is not necessary to remove belt from shaft.*
*No cutting of belt half in two, as with other makes.*



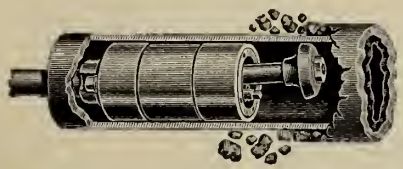
Certainly this is the machine you are looking for. It makes a perfect flexible joint, with no chance for crystalization. Very inexpensive. You can have one on each floor.

CANADIAN SALES AGENTS:

**The GENERAL SUPPLY CO. OF CANADA, LIMITED**

**OTTAWA and WINNIPEG**

The Dean removing scale from the tube of a Water Tube Boiler.



The Dean removing scale from the tube of a Return Tubular Boiler.

## Are Your Boilers Operated Economically?

Wouldn't you like to cut down their fuel consumption—increase their steaming capacity—eliminate loosened and burned out tubes?

## The Dean Boiler Tube Cleaner

is what you need. You will have no idea of what scale is costing you until you see how much you can save after the Dean has thoroughly removed the scale from your boiler tubes.

"Scale Removal Made Easy"—yours for the asking.

THE WM. B. PIERCE CO., - 330 Washington Street,
BUFFALO, N.Y.

## The Nichols Chemical Company, Limited

HEAD OFFICE: 222 ST. JAMES ST., MONTREAL

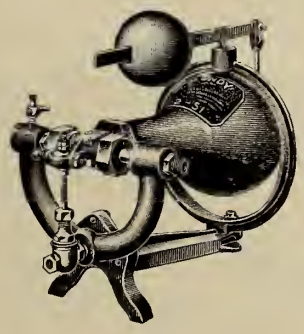
# ACIDS AND CHEMICALS

WORKS:
Capelton, Que.
Sulphide, Ont.
Barnet, B.C.

**TRI-SODIUM PHOSPHATE**
Purest Commercial, 100%, for prevention of scale in boilers.

WAREHOUSES:
Toronto, Ont.
Montreal, Que.

# "Bundy" Traps



**Feed Water Should Be Pure!**

**Condensation IS Chemically Pure!**

**Why Not Return Your Condensation to the Boilers With "BUNDYS"?**

# RUSSEL & GIFFORD

Montreal
Toronto

# Read this Letter:-

The Lakefield Portland Cement Co.

F A Kilbourn Sec Treas
A S Butchart Supt

MANAGERS
J M Kilbourn, Chairman
R P Butchart, W H E Bravender, Vice-Chairmen
F H Kilbourn, H B Smith

26 BANK OF OTTAWA BLDG

TELEPHONE MAIN 2242

MONTREAL, QUE May 15th. 1908.

Messrs. D.K. McLaren Limited,

509 Craig Street West.

City:

Dear Sirs:-

We have much pleasure in stating to you that the $12,000. lot of Belting we purchased from you for the equipment of our new Cement Works here, was a first class lot of stuff and has given us the best of satisfaction.

We might also say that the manner in which you applied the Belts to their different machines in a complete form, although done in mid-winter and under very unfavorable weather conditions, was exceedingly creditable to your men and methods, and left us no grounds whatever for the slightest complaint.

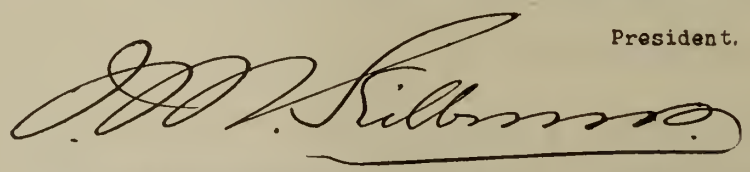
The heavy two-ply Oak Belting supplied for our 100 H.P. motors, and one for a 200 H.P. motor, were without doubt the finest lot of heavy belting we ever saw.

Yours faithfully,

Dict. J.M.K.
M.B.D.

THE LAKEFIELD PORTLAND CEMENT COMPANY.

President.



**NOW SIR,** this gives some indication of the way we are able to satisfy our customers. What we are doing for others we can do for you.

## D. K. McLAREN, LIMITED

**MONTREAL**
309-311 Craig Street West

**TORONTO**
200 King Street West

**QUEBEC**
21 St. Peter Street

**ST. JOHN, N. B.**
64 Prince William Street

**VANCOUVER, B. C.**
418 Abbott Street.

If you have Joint Troubles,
If you have New Pipe Lines to erect,
If you have Superheat, Moisture, Oil, Gas, Water or Acid to care for,
In a word if you have Pipes (screwed or flanged),
Cylinders, Receivers, Economisers, Heaters, Radiators, etc. in use, you require

HAWKINS' IMPERISHABLE JOINTING CEMENT

Send for Booklet and Prices.

BAIN & MITCHELL, Y.M.C.A. Building, MONTREAL

Sole Canadian Agents for

W. T. HAWKINS & CO., HUDDERSFIELD, ENG.

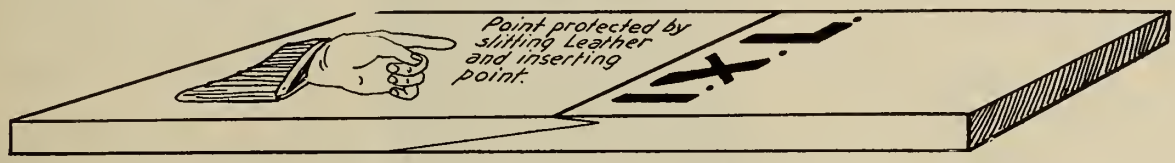
## PLOMO BELT DRESSING

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical—a spoonful will dress an 8-inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places. Permits belts to be run slack without slipping—slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

*Write for booklet and free sample package.*

**THE PLOMO SPECIALTY MFG. CO.**
**CLEVELAND, OHIO.**

## THE "I.X.L." SPLICE "THE BELTING SPLICE THAT WILL NEVER COME OPEN"




The great trouble with *any* belting—no matter how good the leather—that is joined up with the ordinary splice, is the fact that the splices come open, causing loss and delay. J. D. McArthur's Leather Belting made with the "I.X.L." SPLICE, as shown in this cut, *cannot* come open at the splices. Note the protected point, outside point running same direction as pulley. J. D. McArthur's Leather Belting is made from Prime British Oak-Tanned Leather, from Close-Trimmed Backs exclusively.

Write for our complete price list. J. D. McARTHUR & CO., Brockville, Ontario

Stock at Toronto Branch, 639 King St. East; J. E. Stephenson & Co, Agents

J. L. GOODHUE & Co. EXTRA DANVILLE, QUE.

Belt Insurance

Are you insured?

If not, write us.

# The "Transverse-Current" Water Heater

Have You a Gas Engine? Then This is for You. It Will Save All Waste Heat.

Let Your Exhaust Heat Your Boiler Feed Water or Your Factory.

With front and back circulation plates removed, exposing the water passages, and showing their accessibility for cleaning.

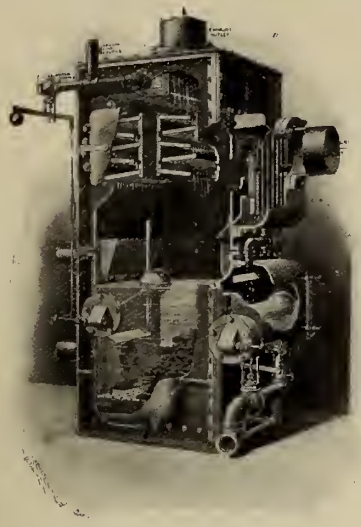
*DO THESE FACTS INTEREST YOU?*

1. The RIBLET is the only Heater that will heat water to the boiling point by waste heat from a GAS ENGINE as well as from a Steam Engine.
2. NOT ONE tube, pipe or joint inside the heater to scale, pull apart, or leak.
3. CLEANS as easily as the open type BUT has no valves or floats to require attention.
4. NO OIL SEPARATOR NEEDED.
5. MADE ENTIRELY OF CAST IRON.
6. CAN'T POSSIBLY GET OUT OF ORDER.

*If so, GET OUR complete descriptive matter and figure out the value to you of this Heater. Write to-day and satisfy yourself.*

## THE RIBLET HEATER CO.

BOX 18 ERIE, PA.



# Progressive Engineering

Every engineer has some plan or other up his sleeve for improving his plant, even if it is a pretty good one already. That is, we find the most progressive engineers are usually a little ahead of their jobs- they have their minds already made up as to some changes that can be made to secure better results in dollars and cents whenever the subject of alterations comes up or they can get the "old man" to appropriate the money.

Take the ***feed water,*** for instance. Any boiler plant where the boilers are fed with water below 210° can hardly be called perfect, since a lower temperature indicates a lost opportunity to save coal and to purify the feed water.

Again, using live steam for ***heating or drying purposes*** while exhaust steam is wasted to atmosphere or is sent to a condenser, is another sign that changes can be made which will improve economy. If you have the right apparatus and piping arrangements, including the new ***Cochrane*** Surplus-Exhaust Heater, or the ***Cochrane*** Oil Separator, the exhaust steam is just as good for heating purposes as live steam, and by saving the pure condensate and using it as boiler feed, water bills can be cut down as well as coal bills.

***Scaly boilers*** are another sure sign that the money-saving possibilities have not been exhausted, especially since our Hot Process System enables you to purify the water at the same time that you heat it, and at but little extra expense, since you should have a heater anyway.

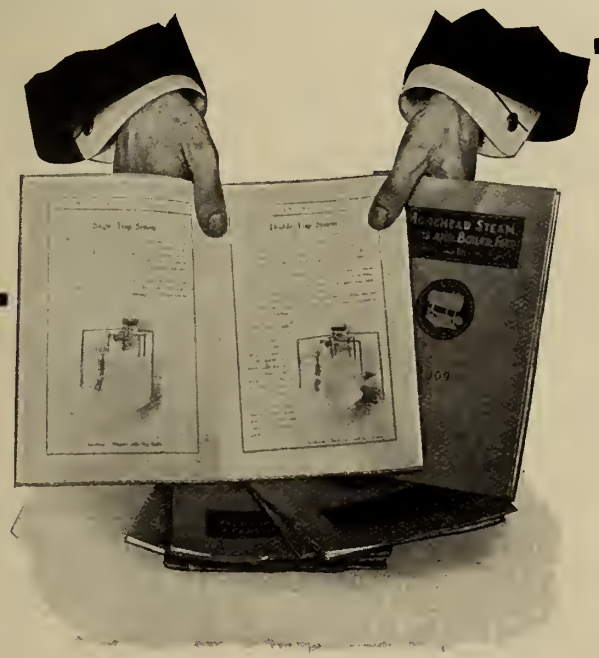
We have not space to go into all these subjects here but would be glad to send you any of the following books, which contain a great deal of valuable information drawn from the experience of practical men:

*"The Profitable Utilization of Exhaust Steam."*
*"What Scale Does to Boilers."*
*"Hot, Soft Water for Boiler Feeding."*
*"Oil and Steam Separator Talks"*

A postal card will bring you information that may mean more money for your employer—and for you,

## CANADA FOUNDRY COMPANY, LIMITED

**Toronto Montreal Halifax Ottawa Winnipeg Calgary Vancouver Rossland**



# BOILER FEEDING

with a

# MOREHEAD

## Return Steam Trap and Boiler Feed

is the most simple, economical and satisfactory method in existence to-day It is a modern idea developed by the demand for a boiler feed using less steam than the ordinary pump and more efficient in operation.

The Morehead Return Trap consumes less than 10 lbs. of steam per horse power hour; steam pumps require from 90 to 120 lbs. The Morehead Trap method is superior from every point of view.

**Full information will be found in our Trap Book.**

## Our "Trap Book"

contains much that is invaluable to every engineer and power plant operator. It is chock full of interesting text and illustrations on the feeding of boilers the modern way.

HOW TO GET ONE? Simply tear out this advertisement, write your name and address on the margin and mail it to the

**MOREHEAD MFG. CO. 775 Grand River Ave. DETROIT. MICH.**

**Canadian Representatives:**—A. R. Williams Machinery Co., Toronto; W. H. Markle, Montreal; Park Bros., Chatham, Ont.

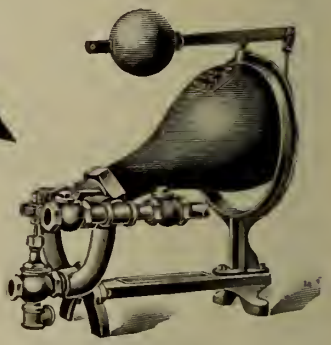
# A Quality Trio of Feed-Water Auxiliaries For Effecting Power Plant Economies

To be had through

## Peiler & Mackenzie

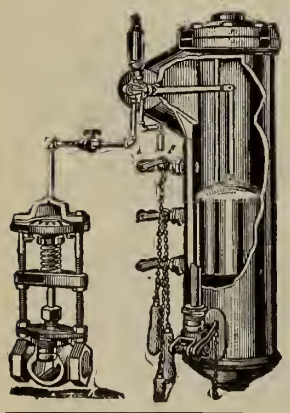
52 St. James St.
Montreal

Catalogs And Further Particulars Cheerfully Furnished On Request



### Bundy Traps

For returning all condensed water to boilers from any part of the plant.
Absolutely guaranteed

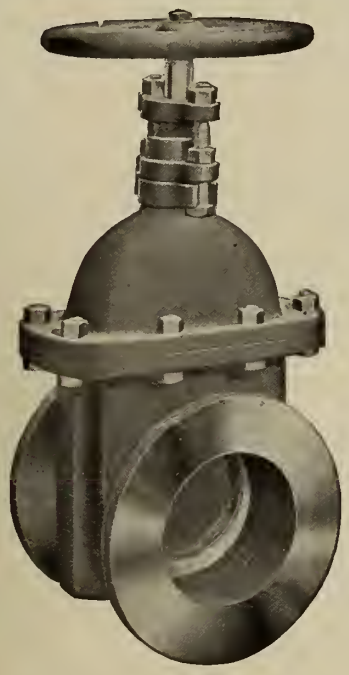


### THE Berry Feed-water Regulator

Guaranteed to keep the water level within half inch limits.
This is practically Absolute Normal Water Level.

### THE Reilly Multicoil Feed-water Heater

Continuous Efficiency.
One-third the size and weight for same capacity of any other on the market.



## KERR GATE VALVES

*are to be found in all well equipped steam plants in Canada.*

*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

**The Kerr Engine Co., Limited**

**Valve Manufacturers**

**Walkerville, - Ontario**

# WHY

WASTE YOUR TIME HUNTING THROUGH A NUMBER OF OTHER CATALOGS WHEN BY SIMPLY CONSULTING THE INDEX OF

## LUNKENHEIMER RED BOOK No. 46

YOU CAN IMMEDIATELY FIND WHAT YOU WANT IN THE LINE OF HIGH-GRADE VALVES AND OTHER ENGINEERING APPLIANCES. IF YOU HAVEN'T A COPY WRITE FOR ONE. IT'S FREE.

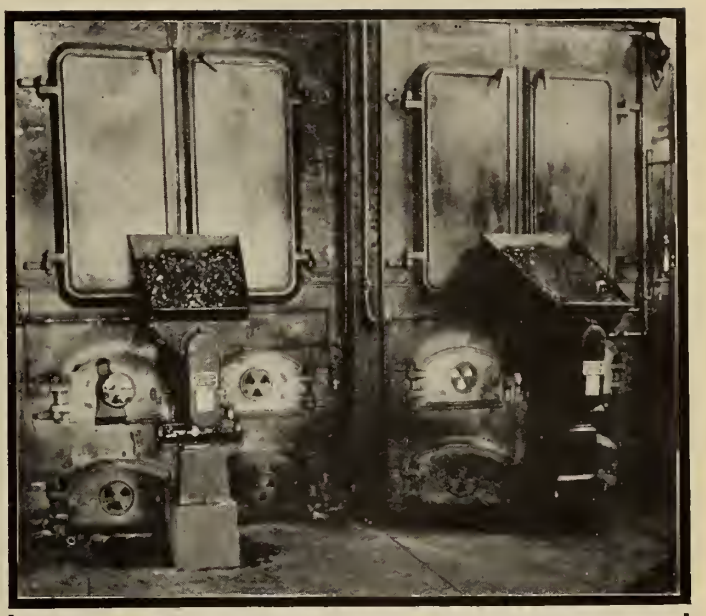
**THE LUNKENHEIMER COMPANY**

LARGEST MANUFACTURERS OF HIGH-GRADE ENGINEERING SPECIALTIES IN THE WORLD

General Offices & Works, CINCINNATI, Ohio, U.S.A.

BRANCHES { New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E., 35 Great Dover St.

34



ERIE STOKER AT WEBSTER CITIZENS CO., BUFFALO, N.Y.

# Erie Stoker

**$350.00** *F.O.B., Erie, Pa.*

This Stoker does what the most expert fireman would do, providing he were—

**—absolutely tireless**
**—absolutely careful**
**—absolutely loyal**

—and if he could fire without opening the doors of the furnace.

## Feeds the coal, doesn't burn it

—without opening furnace doors it spreads the coal. Then it is up to the boiler.

And it works for almost nothing.

Being outside the firebox, there are almost no repairs to make---and what few there are can easily be made without stopping the plant and without calling in the aid of a high-priced expert.

**Let us send it on sixty days' trial**

Here is an opportunity never offered before. No stoker has ever sold at anywhere near this price. And you can try it out yourself —in your own plant—with the privilege of returning it at our expense for freight, if you think you can get along without it.

Investigate this without delay. Sign and mail the coupon at once.

**ERIE FOUNDRY CO., Erie, Pa., U.S.A.**

Messrs. Scott, Campbell & Co., 503 McKinnon Bldg., Toronto, Ont.
I want to know more about the Erie Stoker.

NAME.....
STREET.....
CITY.....PROVINCE.....
NAME OF MY FIRM.....

# COAL

## Jules G. Hoffman

Miner and Shipper
of

**High-Grade Steam & Gas Coals**

**Blacksmith Coal & Coke**

Quality Guaranteed

General Offices - - 420-423 Hammond Bldg.
Detroit, Michigan, : : : U. S. A.

## Potato Scale Powder Boiler Cleanser

**is a Fuel Saver**

This composition will positively keep your Boiler from foaming, and is guaranteed not to injure boiler pipes, shell or connections.

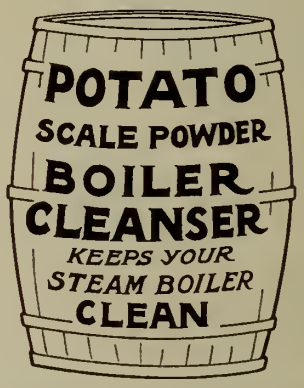
Mail me sample of your feed water, and I will prove that I can keep your boiler clean without damage. Send to-day. It costs you nothing.

**Sole Agent for America**

## C. C. SNOWDON

Wholesale Oil Merchant — CALGARY, Alta.

All Correspondence to CALGARY




Branch Storage NEW YORK and MONTREAL

## *Does Your Feed Water Leave Scale in Your Boilers?*

## *Are You a Victim of the Tube Cleaning Habit?*

We can cure BOTH these time and labor devouring habits and absolutely guarantee results. If we fail you won't be charged one cent.

## *NOTE THIS "Money Back" Proposition.*

¶ We ask you to send (AT OUR EXPENSE) a gallon of the feed water used in your plant and the approximate amount of water used per day. We will have it carefully analysed in our laboratory and will prepare a barrel of "SKALEOFF" ***especially to suit your own particular requirements.***

¶ This we will ship to you, to test and judge for yourself. If it is not satisfactory, you will not be charged a cent. If it is—talk business. Send sample to-day and let us get started on the analysis.

***THE "SKALEOFF" CO. - 97 SHANNON STREET, MONTREAL***

# BOILER SCALE *is an Expensive* NUISANCE

YOU needn't have SCALE in your boiler; there's a sure and cheap way of preventing scale formation.

¶ A stock compound won't do it! Don't let anyone delude you as to this.

¶ The only sure way is to have your feed water analysed, and some RED STAR COMPOUND made up to combat the conditions disclosed by the analysis.

¶ We are willing to analyse your feed water absolutely free of charge. Just express us a gallon and we will make up some "Red Star" Compound that we positively guarantee will remove old scale from your boiler, and prevent the formation of new scale.

¶ This is your opportunity to effect an immediate and permanent saving in fuel by eliminating all scale from your boilers.

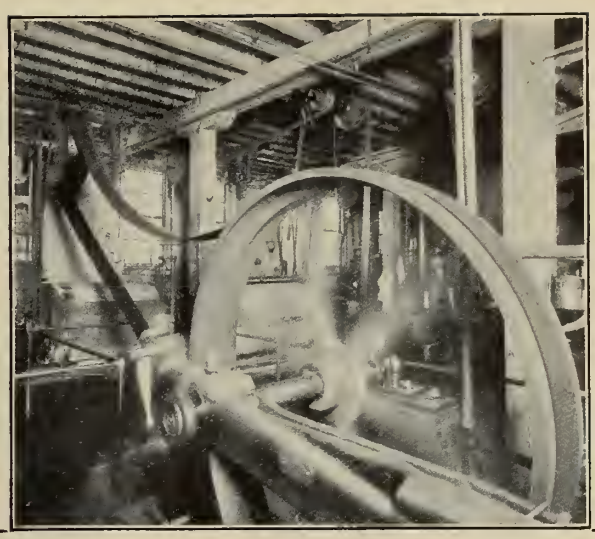
¶ Send us a gallon of your feed water to-day.

---

**Hygienic Laboratories Ltd.**

11 Colborne Street, TORONTO





# Cling-Surface
## For Canadian Belts

There is, without doubt, more Cling-Surface used in Canada than the total of all other materials.

Because only Cling-Surface will permit all belts and ropes to be run easy or slack and carry full loads, and at the same time make and keep them pliable, water-proof and preserved.

It contains no rosin and is not sticky, but penetrates *into* the belts and ropes, where they need it.

The running of belts slack means ease on belts, bearings, shafting and engine, cool bearings, economy of oil, saving of the time and labor in keeping belts tight and increased power at machines.

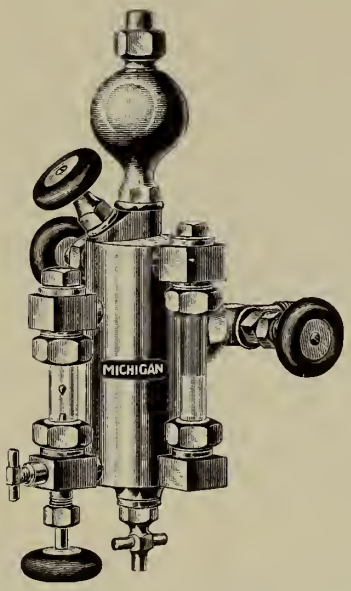
This belt has run 6 years in the I.X.L. Laundry, Toronto, with Cling-Surface, in heat and steam. It is 9" leather, 8' to 42" pulleys, 17' centers, 45 H.P. load when photographed, 2050 ft. P.M. 40" slack, and never slips.

We guarantee Cling-Surface to give you the best belt service you ever had. We quote f.o.b. Toronto, duty paid. Write for special trial terms and printed matter. Write now.

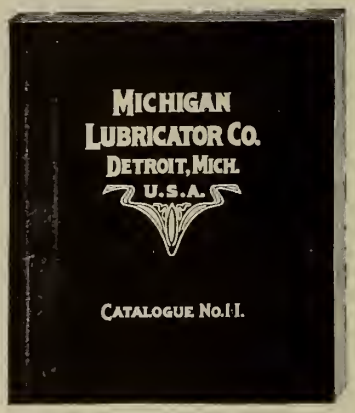
**Cling-Surface Company**

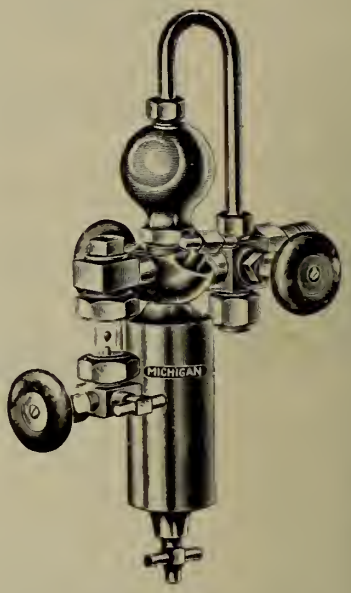
1057 Niagara Street, Buffalo, N.Y.

# MICHIGAN




Illustrated catalog mailed to you free




WRITE TO-DAY

## MICHIGAN LUBRICATOR CO.

DETROIT, MICH.

## EVERY ENGINEER SHOULD KNOW

ALL ABOUT

**WEAR WELL** LEATHER **WELL** PACKINGS

You have packing troubles and have never known where to procure Packings that would give satisfactory service. We manufacture "Wear Well Leather Packings" from the highest quality of leather, work to your specifications and guarantee every Packing to give satisfaction.

Made in all sizes and styles for use in Hydraulic and Compressed Air Machinery. Write for descriptive booklet.

## Detroit Leather Specialty Company, Inc.

DETROIT 87 Beecher Avenue MICHIGAN

# The Dart Flange Union

## Bronze to Bronze Ground Joint

## DART FLANGES

require no packing—
They never leak and
are easily installed.

Send us trial order.

Fully guaranteed.

**Dart Union Company, Limited**

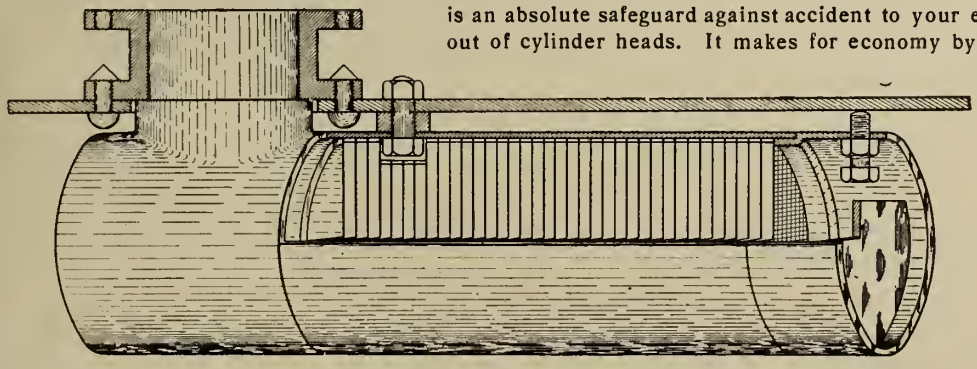
93 Niagara Street

TORONTO

## The Most Difficult Problem

which confronts the modern engineer is the delivery of the steam to the piston free of entrained water and foreign matter. Wet steam is unnecessary, expensive and dangerous.

# THE IDEAL INTERNAL STEAM SEPARATOR



is an absolute safeguard against accident to your engine by water shock or the going-out of cylinder heads. It makes for economy by saving oil, packing and time, and lessens the wear and tear of engines, pumps and compressors. This system of separation at the *initial point* fills a long-felt want, and appeals to the *up-to-date* engineer at once.

Remember the first cost is the whole cost! The "Ideal" requires no subsequent attention.

*Write for descriptive booklet*

*Some other lines we manufacture, each having distinctive features, are:*
POTTER SEPARATORS; WHALEY AUTOMATIC SMOKE PREVENTERS; LEONHARDT GAUGE GLASS PROTECTORS
*WRITE FOR DETAILS AND PRICES OF THESE*

*We are Selling Agents for:*
WATSON & McDANIEL CO., Philadelphia, (Steam Traps and Other Specialties); SIMS FEED WATER HEATERS, Erie, Pa.; HARRIS SMOKELESS FURNACE CO., Nashville, Tenn.
*WRITE FOR CATALOGUES*

## IDEAL STEAM SEPARATOR AND SUPPLY CO.

**75 Adelaide Street East, TORONTO, Ontario**

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA

## On Account

of their Extremely Low Cost of Operation and the Small Amount of Attention Required

# Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**
Coristine Bldg., Montreal
Phone Main 1054
*Works - - - - - Seneca Falls, N.Y.*



# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**

# Would $4.20 Pay for the Repairs to Your Grates for the past 2 YEARS?

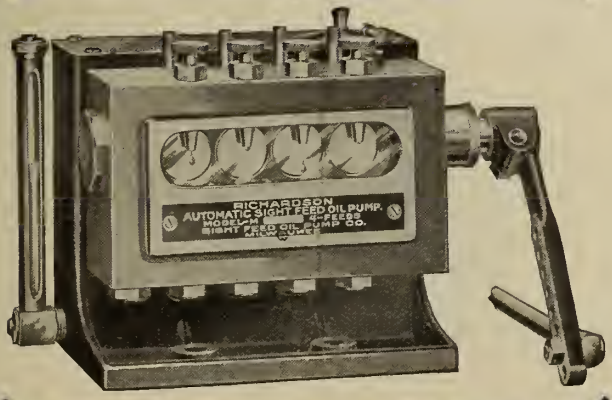
Yet this amount is the only expense for repairs that the Belgo-Canadian Pulp & Paper Co. have had on the Venetian Grates with which we furnished them for a 212 H.P. boiler nearly two years ago.

Just think this over. Only $2.10 per year, and the grates in continuous use day and night during that time, and no artificial draft as previously required.

Another point: You can burn Anthracite screenings at $1.85 per ton and get a flame 8 feet long; there is NO SMOKE, and there is a large saving in fuel.

The reason is simple: 'Tis all in the construction, which is as simple as the reason. Let us tell you more about these grates.

**The Canada Gas Power & Fuel Co.,** 68 St. James St. **Montreal**




## Automatic Lubrication

**The Richardson Automatic Pump, Model M**

Automatic lubrication is a good feature—**uniform** lubrication is **better,** because it's **economical.**

The delivery of large quantities of oil at long intervals is a wrong principle—entirely. No man can eat enough at one meal to last him three days, and no engine can consume sufficient oil at one time to last twenty revolutions. Enough oil can be **delivered** but only **half** is used. The other half runs through the engine and becomes waste.

The **one correct way** is the **Model M** way, a delivery of sufficient oil to the steam at **every** revolution of the engine. Thus, you get a dollar's worth of service from every dollar's worth of oil.

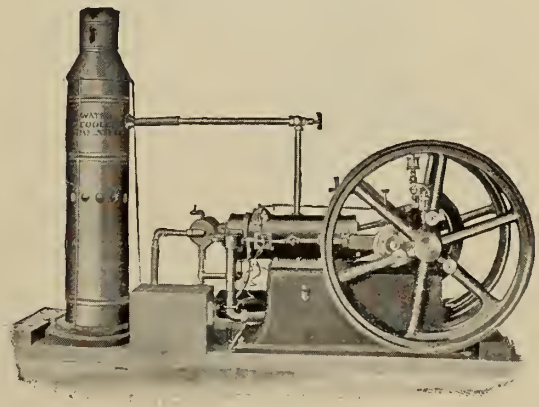
Send for Bulletin No. 209-L.

**SIGHT FEED OIL PUMP CO., Milwaukee, Wis.**

THE WATKINS SERVICE CHICAGO

# GAS and GASOLINE ENGINES

## 1½ to25 H.P.



If interested it will pay you to write for our Catalogue

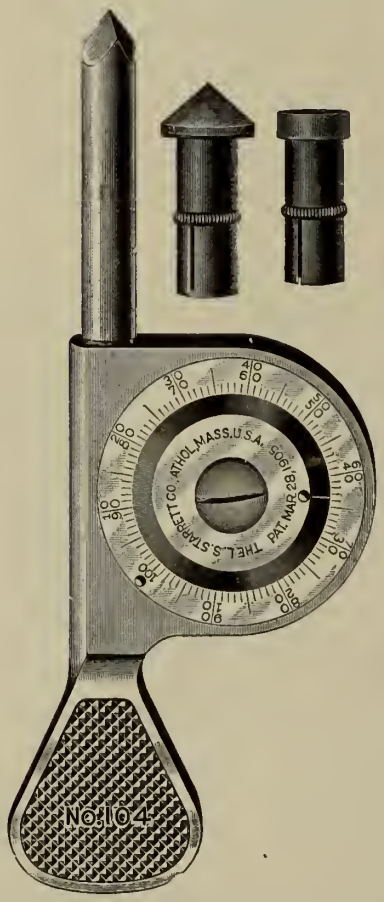
**Goold, Shapley & Muir Co.**
Limited

**BRANTFORD - CANADA**

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE," by sending two new paid-up subscriptions ; If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

PUBLISHED MONTHLY AT $1.00 PER YEAR.
Start in TO-DAY to earn one of these handy Tools.

**THE POWER HOUSE**
10 Front Street East TORONTO



# DOMINION BELTING CO., Limited
HAMILTON, CANADA

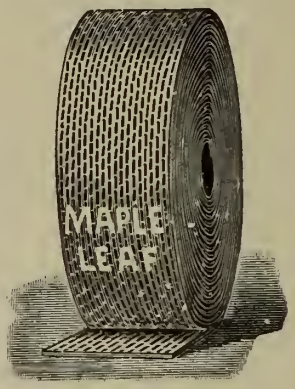
SOLE MANUFACTURERS OF THE CELEBRATED

## "MAPLE LEAF" BRAND
## Stitched Cotton Duck Belting

FOR TRANSMISSION OF POWER, CARRYING, ETC.

THE TRUEST RUNNING

THE STRONGEST



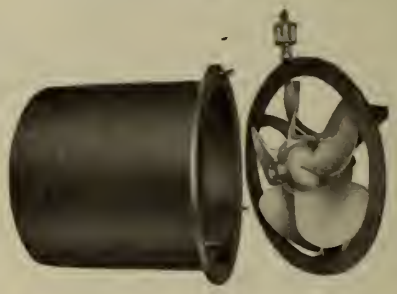

THE MOST ECONOMICAL BELT

MADE IN CANADA

As a Main Drive Belt "Maple Leaf" cannot be excelled. Write for prices.

"MAPLE LEAF" BELT DRESSING is the best on the market for all kinds of belts.





# If You Wish to Save Money

in operating your steam plant, and at the same time increase its capacity at no extra expense,

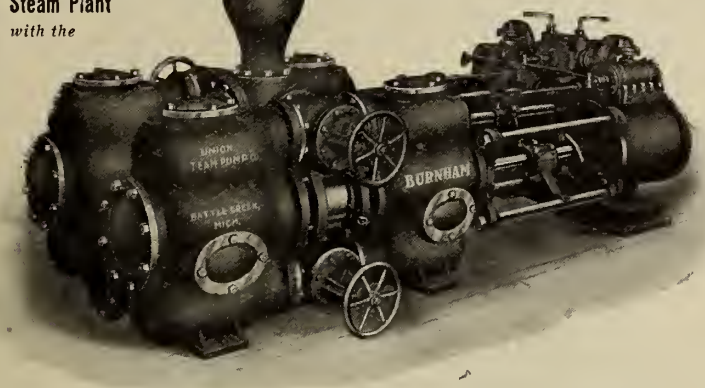
Write for particulars of The TURBO-BLOWER SYSTEM of MECHANICAL DRAFT

TURBO-BLOWER CO., 30 Church Street, NEW YORK, N.Y

For Eastern Canada : W. H. Adams, 102 Nazareth St., Montreal.
For Western Canada : Standard Engineering Co., Ltd.
47 Wellington St. East, Toronto.

No Short Stroking
No Stoppage of Steam Plant
*with the*

# BURNHAM TWIN PUMP



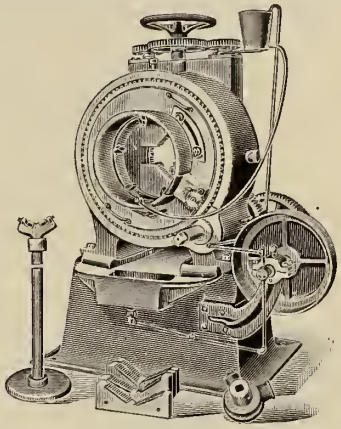

Examine the cut closely and you will see that by simply operating a lever you have all the advantages of the Single Cylinder Pump. This special feature alone is worth the difference in the first cost of the **Burnham Twin Pump** If one side of a Duplex Pump becomes disabled the complete pump is put out of service.

This is not the case with the **Burnham Twin Pump**, as either pump can be *operated independent* of the other, or as one pump.
**Burnham Pumps** have 60% *less clearance* on the Steam Cylinder, do not short stroke, and are self-governing.
**The Standard BURNHAM PUMP is Brass Fitted throughout, and is suitable for Hot or Cold Water,**
☞If interested, write for Pamphlet T

**DARLING BROTHERS,** Head Office and Works, 15 Ottawa St., Montreal. Toronto, Winnipeg St. John, N.B.

**Power Users or Engineers wanting the name and address of the manufacturer of any class of power equipment or supplies, not advertised in The Power House, will be able to obtain same by writing to the editor of this journal.**

# ENGINEERS



are looking for the best tool which does the most work in the shortest time at the least expense. Such a tool is the

## Forbes Patent Die Stock

On its base it stands complete as Power Machine. Off its base, complete Hand Machine. Many other features described in catalog.

*Ask for catalog*

**THE CURTIS & CURTIS CO.**
26 Garden Street,
BRIDGEPORT, CONN., U. S. A.

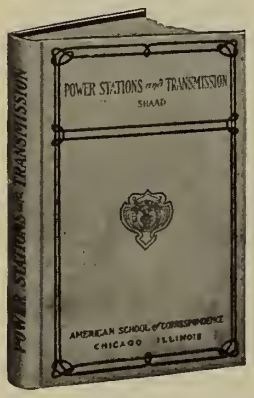
# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

**NEW YORK CITY BRANCH, 1402 BROADWAY** **McLEOD & HENRY CO.** **MAIN OFFICE & WORKS TROY, N.Y.**

# Practical Books For Engineers

The engineer who would be a success must supplement his practical work by the reading of standard works on engineering. We carry a complete stock of these books, among which are the following :—

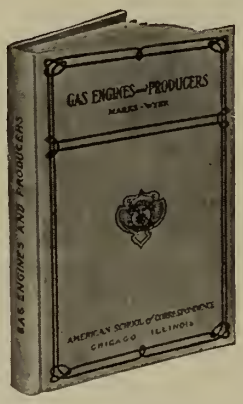



## Power Stations and Transmission

**By George C. Shaad, E.E.**

Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. 176 pp., 43 illus. Cloth binding. A manual for Electrical Engineers and Electrical Workers in general. It represents the accumulation of years of practical experience by the best authorities, and should be in the hands of every worker in the great field of electricity and of every other practical man, no matter what his business, who is interested in the development of electrical power.

**Price.....$1.00**




## Gas Engines and Producers

**By Lionel S. Marks, S B., M.M.E.**

Assistant Professor of Mechanical Engineering, Harvard University, American Socicty of Mechanical Engineers, and Samuel S. Wyer, Mechanical Engineer, American Society of Mechanical Engineers. 160 pp., 90 illus. Cloth binding. Embodying the latest information in this rapidly developing field. Of immensc practical value to all Engineers, Machinists, power-plant owners or managers, etc.,—in fact, all interested in efficient and economical power production.

**Price.....$1.00**

## New Catechism of Electricity

**By N. Hawkins, M.E.**

Price $2.00. 550 Pages, 300 Illustrations.

A practical treatise on the care and management of electric plants and apparatus—a book to aid the average man rather than the inventor or experimenter. It contains all the (book) information necessary for an experienced man to take charge of a dynamo or plant of any size. Contents include Dynamo, Electric Lighting, Electric Railway, Telephone and Telegraph, etc. Bound in red leather, pocket-book form.

## Modern Steam Engineering in Theory and Practice

**By G. D. Hiscox**

Price $3.00. 450 Pages, 400 Illustrations.

This book has been specially prepared for the use of the modern steam engineer, the technical students, and all who desire the latest and most reliable information on steam and steam boilers, the machinery of power, the steam turbine, electric power and lighting plants, etc.

**Further information regarding the above or other Engineering Books given on application to**

# MacLean Publishing Company

TECHNICAL BOOK DEPARTMENT

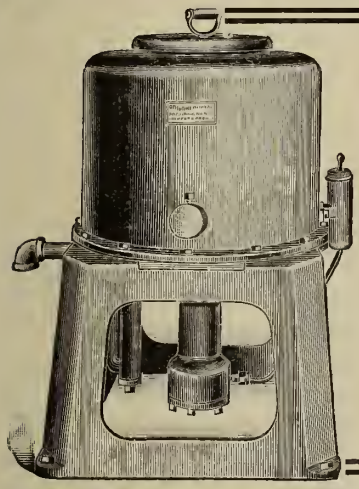
10 Front St. East, - Toronto, Canada

# Sadler & Haworth

ESTABLISHED • 1876

"CLIMAX" **In Oak Tanned Leather Belting These Brands Are the Best.** "AMPHIBIA" (WATERPROOF)

**Factories at Montreal and Toronto - Stock Depots : St. John, N. B., Winnipeg, Calgary, Vancouver**



## Save the Oil—Don't Waste Waste

You simply have to place the dirty waste in this machine, turn on the steam and in half an hour the waste is perfectly clean and the oil—90% of it—is ready for use again.

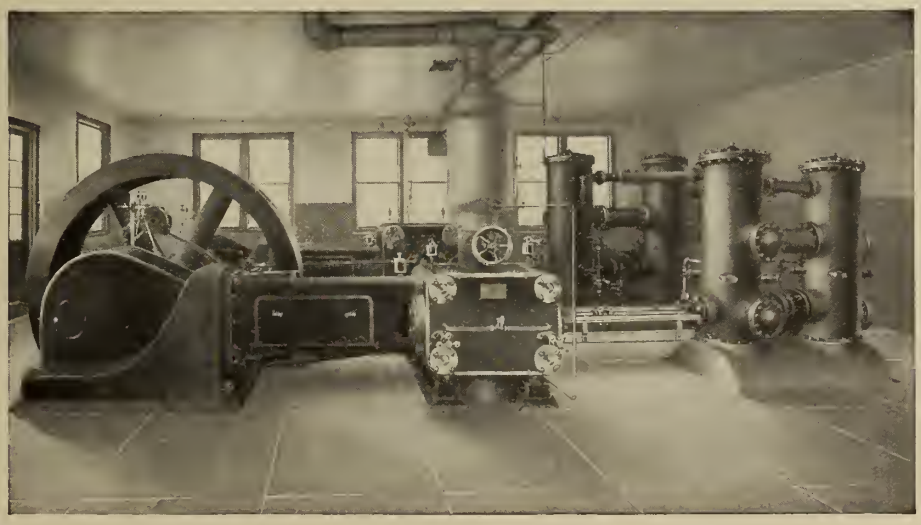
We have machines with—The E. B. Eddy Co., Ltd.; Grand Trunk Ry.; Canadian Pacific Ry.; Dominion Coal Co.; J. R. Booth; Toronto Water Works; T. Eaton Co.; Montreal Street Ry.; Nova Scotia Steel & Coal Co.; Toronto Railway; Algoma Steel Co.; Quaker Oats Co.; B. Greening Wire Co.; Imperial Oil Co.; Canadian Copper Co.; Sarnia Electric Light Co.; Robt. Mitchell Co.; Montreal Rolling Mills; Canada Screw Co.; Crow's Nest Pass Coal Co.; Dominion Iron & Steel Co.; Temiskaming & Northern Ontario Railway Co.; Consolidated Mining & Smelting Co.; Montreal Cotton Co.; Frost & Wood Co., Ltd., and many others.

ASK FOR CATALOGUE

**The Canadian Oil and Waste Saving Machine Co.** Limited

BROCKVILLE, ONTARIO

# ROBB POWER PLANTS



## ENGINES

Corliss, Slide Valve, Horizontal, Vertical

## BOILERS

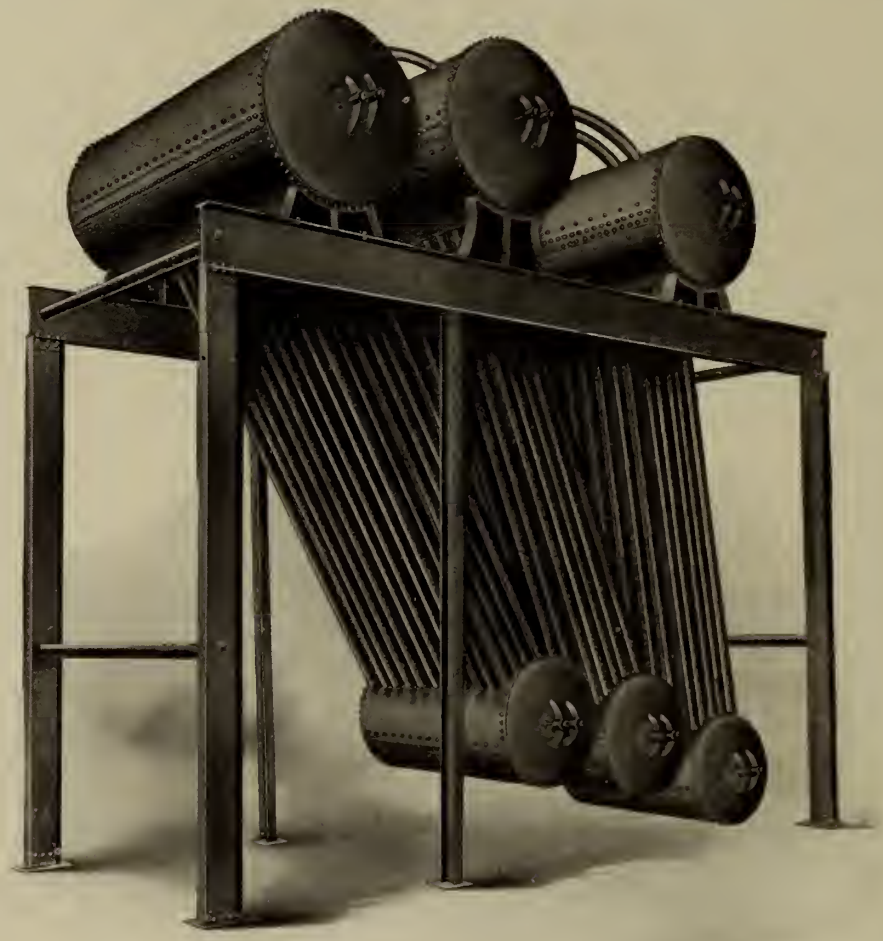
Return Tubular, Water Tube, Internally Fired, Portable

**Robb Engineering Co., Limited, Amherst, N.S.**

DISTRICT OFFICES
- 709 Power Building, MONTREAL; Watson Jack, Manager.
- Traders Bank Building, TORONTO; Wm. McKay, Manager.
- Union Bank Building, WINNIPEG; W. F. Porter, Manager
- Calgary Block, CALGARY; J. F. Porter, Manager.

# Water Tube Boilers

## Return Tubular, Horizontal Marine, Vertical and Portable Boilers, with or without Wheels



Side View of our NEW WATER TUBE BOILER. Not bricked in.

## Our Engines, Boilers, Heaters, Pumps and Condensers are Prominent in Canada's Largest Power Houses.

## The Goldie & McCulloch Co., Ltd.

### Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

BRITISH COLUMBIA AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Boilers, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

Ask for Catalogues, Prices and All Information.

# BOILER FEED WATER *and* ITS TREATMENT

By G. C. KEITH, B.Sc.

There are many things in a power plant, which demand the attention of the engineer and which enter into the efficiency of the plant. In order that a maximum efficiency may be obtained all losses must be at a minimum. Many opportunities exist for increasing the efficiency, one being the method of operation. In this article it is proposed to treat one phase of the subject of operating the steam plant, the treatment of feed water entering the boiler. The presence of foreign matter in water makes it imperative that an engineer should understand what he may find in boiler feed water and how to deal with scale and sediment forming waters, to eliminate the troubles that arise from them.

### Hard Water.

Water from lakes, river, brooks, springs, and wells is commonly known as hard water, since being a great absorbant, it has dissolved in it, lime and minerals, in passing through the earth. Very few waters in their natural condition, are fit to be fed directly into the boiler. Even so simple a boiler as a kitchen kettle becomes covered with deposits of baked earth and of crystallized and calcined minerals. What, then, may an engineer expect in a steam boiler where the heat is so much higher in temperature and the pressure so great. Lime may be present in three forms: sulphate of lime (gpsum and plaster of paris) ; bicarbonate (lime and chalk) ; and chlorides (common salt). An acid water will contain more lime than neutral water. Other impurities found in feed water are magnesia, silica, iron, alumina, organic matter, etc.

Magnesia is a white powder which dissolves in water containing carbonic acid. It is similar to lime except that the sulphate of magnesia, known as epsom salts, is used as a medicine.

Sodium chloride or common salt is found in nearly all natural waters, though fresh waters contain very small quantities of it. Sodium chloride causes pitting and corrosion when of sufficient strength.

Silica (common sand, quartz, flint, etc.), is found in most waters, though the quantity is small. It usually combines with the lime or magnesia in the boiler.

Iron, alumina, etc., are usually in very small quantities and only in few waters must they be taken into consideration. Organic matter is distinguished as vegetable mucilage obtained from various plants in shallow water. This acts as a glue or cement in binding lime or magnesia to iron.

To feed water containing these impurities into a steam boiler, to evaporate it in large quantities thus concentrating the matter in suspension, to expose it to a heat sufficient to precipitate the salts in solution, and to thus cause it to adhere to the boiler in coatings as hard as a rock is a performance unbecoming an engineer. It is elementary, wasteful and very unscientific.

### Solution of the Problem.

The solution of the problem is to put clean water into the boiler and keep the boiler clean. In condensing plants water may be used over and over again by using an oil separator to remove the oil from the condensed water. Frequently the operation of purifying may be combined with the heating of the feed water and there is also the mechanical and chemical method of purification. The two methods of purification by heating and mechanical sediment removing, are familiar to most engineers. The third method, that of chemical treatment is either not known, or else so many engineers have been "bitten" by "stock" compounds that they become wary and are content to run their boiler inefficiently.

### Scab Lowers Efficiency.

To show how the efficiency of a boiler is lowered when incrustation is allowed to collect, it is claimed that a layer of 1-16 inch on the tubes of a multi-tubular boiler causes a loss of from 15 to 20 per cent. of fuel, and the loss increases rapidly as the thickness increases; ¼ inch thick requires about 60 per cent. more fuel and ½ inch thick requires about 150 per cent. more fuel. The above varies, of course, for different boilers and on some the per cent. loss may be a little less.

### Pitting.

Reference has been made to pitting of boilers by sodium chloride (common salt). Pitting is one of the most common causes of injury to the boilers. It may be caused by free oxygen, carbonic oxide or certain mineral salts, especially chlorides as mentioned above. Nearly all waters contain oxygen in solution, and this combines with the iron in the boiler tubes and plates to form iron oxide, which is removed from the place where it is formed by blowing off the boiler, and leaves a pit mark on the tube or plate. Pitting is also explained by galvanic action, that is the carbon in the iron and the chlorides (whether of sodium, magnesium or calcium) form a galvanic battery, by the action of which the particle of carbon imbedded in the iron is eaten away or disintegrated in much the same way as water pipes are eaten away by electrolysis.

Oil and grease should be excluded from the boiler. The trouble of oil in the boiler feed water is found most in condensing plants where the water is used over and over again. A writer gives the following illustration of the injurious effect of oil. A film of grease one-hundredth of an inch thick, a layer of scale one-tenth of an inch thick, and a boiler plate ten iches thick offers equal resistance to the passage of heat.

### Use of Kerosene.

Some engineers use kerosene or crude oil as a scale remover. It is claimed that it is the acid in the oil that removes the scale and this acid is injurious to boilers. The vapor may pass into the engine and do serious damage. Some boiler insurance companies prohibit the use of oil in boilers holding insurance policies from them. Oil is purified with sulphuric acid and this acid attacks and corrodes the boiler. Engineers should not use kerosene as a scale loosener.

### Boiler Compounds.

Many feed waters can be successfully treated by a scientifically prepared boiler compound. By scientifically prepared, is meant compounds prescribed for a particular feed-water, an analysis of which has been made to find the materials contained in solution. Engineers should beware of "stock" compounds. It is erroneous to think a compound will suit water whether in Ontario, Nova Scotia or Alberta. It must be re-

membered that water taken from the same river a few miles apart will show a difference by an analysis, and requires a different treatment.

The successful use of a compound, when the correct compound is obtained, is accomplished by using the proper quantity, otherwise the proper result will not be obtained.

The chemical treatment of feed water causes a by-product to be formed. If the lime carbonate or sulphate is converted into another salt of lime with an inorganic chemical salt, it must be converted into a soluble one, when the correct compound is obtained, is accomplished by using the proper quantity, otherwise the desired result will not be obtained. Foaming is, as a rule, eliminated by removing the floating material; vegetable matter by filtering or surface skimming and incrustation and scale forming matter by a scientifically prepared compound.

| Trouble | Cause | Cure |
|---|---|---|
| INCRUSTATION | Sediment, Mud, Clay, etc. | Filtration |
| | Readily Soluble Salts. | Blowing-off |
| | Bicarbonate of Magnesia, Lime, Iron | Heating: Feed and Precipitate |
| | | Caustic Soda |
| | | Lime |
| | | Magnesia |
| | Organic Matter. | See below |
| | Sulphate of Lime. | Sodium carbonate |
| | | Barium chloride |
| CORROSION | Organic matter | Precip. with alum and filter |
| | | Precip. with ferric chloride and filter |
| | Grease | Slaked lime and Sodium carbonate and filter |
| | Chloride or Sulphate of Magnesium | Sodium carbonate |
| | Sugars | |
| | Acid | Sodium carbonate |
| | Dissolved Carbonic Acid and Oxygen | Slaked lime |
| | | Caustic soda |
| | | Heating |
| | Electrolytic Action | Zinc plates |
| PRIMING | Sewage | Precip. with alum or ferric chloride and filter. |
| | Alkalies | Heating feed and precipitate |
| | Carbonate of soda in large quantities | Barium chloride |

### Troubles and Their Cure.

The following table for the treatment of boiler feed water was included in a paper read by Hunt & Clapp before the American Society of Mechanical Engineers. This chart has been widely quoted and should be of interest.

## THE COLD WATER DELUSION.

We have repeatedly discussed the pernicious fallacy that injecting cold water upon over-heated boiler-sheets is likely to cause an explosion ; but the mistaken impressions upon that subject are so difficult to eradicate from popular belief that we return to the subject from a sense of duty.

When water in a boiler is found to be low, the first duty of the man in charge is to force water inside as quickly as possible. The belief that boilers with overheated sheets were likely to explode if cold water was injected upon the plates arose no doubt from the fact that hot cast-iron plates often fracture when cold water is thrown upon them. It is, however, different with the mild steel that steam boilers are made of. That material softens or becomes annealed when quenched in cold water, a simple test proving the truth of that, which any mechanic or engineer can carry out for himself. The beginning of this most unfortunate "red hot cold water" boiler explosion theory was a philosophical experiment conducted by an English professor as follows : He first observed that water in small quantities dropped upon very hot metal did not wet the metal, nor was it evaporated in the usual way. He then took a platinum dish, heated it red-hot by means of an alcohol lamp, and into this poured a small quantity of water ; he found that it assumed globular form without seeming to touch the metal, and appeared to be held away by an invisible cushion. It did not evaporate rapidly, but slowly dried away, until at a certain time the remaining drop exploded with great violence. He then deduced and proclaimed the theory of the spheroidal condition in red-hot boilers, which was to account for all mysterious boiler explosions.

This theory concerning boilers exploding by cold water being pumped upon hot plates took such a firm hold upon people entrusted with the care of boilers, that the Pennsylvania Railroad Co. determined to make tests to demonstrate the fallacy of the popular delusion. A locomotive was run out on a side track near Altoona, and the plan was to fire the boiler until the steam was high, then blow it out to expose the crown sheet and allow it to become red-hot, then to force cold water into the boiler from a fire-engine placed at a safe distance away. The first plan miscarried, for they fired the old boiler while full of water till the steam reached 200lb., when it suddenly went to pieces. That proved that being full of water did not prevent a boiler from exploding.

The company then took a second old engine to repeat the tests. The boiler was fired up, and steam raised considerably above the regular working pressure. Then they ran the water off until the crown sheet was bare, and allowed it to become red-hot, after which they pumped in cold water. The only effect was to cause the seams to leak.

About the same time a series of experiments were made at the Harrison Boiler Works in Philadelphia, with overheated plates, under the supervision of the Franklin Institute. Several boilers were overheated, and cold water pumped upon the red-hot sheets. The experiments were very interesting, and very conclusive that the whole mass of the boiler, if heated red-hot, does not contain heat units enough to raise the water to a dangerous steam-making pressure.

All men connected with boilers should remember not to let the water in the boiler get low. But if by accident it should become low, hurry to put water inside.—"Railway and Locomotive Engineering."

There are some differing opinions in regard to this subject and we wish to get the opinion of engineers. Write a post card giving us your views and experience. If the water gets so low as to be out of sight in the glass, we would advise covering the fire with ashes or coal and allowing the boiler to cool at once. We think it is the safest plan.—The Editor.

## VOLATILITY OF GASOLENE TEST.

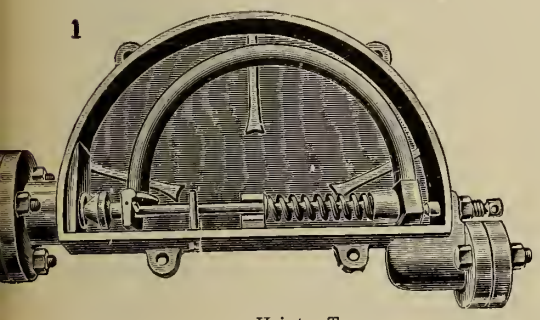
A very simple test can be made to show the volatility of gasoline by moistening the hand with the liquid and noting the time it takes to evaporate. Common stove gasoline, known as 71 test, will take from 7 to 19 seconds to evaporate, leaving the surface of the hand perfectly dry. Lower grades will take much longer time. Should there be any greasy residue left on the hand the fuel is not fit for use in a gasoline engine.

# The Steam Trap: An Important Economy in the Power Plant

## A Short History of the Steam Trap—Different Types now on the Market—Their Application—Hints to Engineers Regarding Purchase.

By H. L. PEILER

Among all the appliances that are in every day use in steam plants, one of the most used and also most abused is the steam trap. It is a most curious fact that there is relatively much less known of this useful member of the engineering family than of almost any one other appliance that enters into the ordinary economy of the boiler room. It is probably due to this lack of knowledge of the chief principles involved in the proper use of traps that so many engineers are of the opinion that there is no such thing as a reliable steam-trap, when a little examination into the question and a little more knowledge of the subject would in all likelihood enable those same engineers to solve many problems that appear to be more difficult than they really are. And yet, the steam trap is not a new invention. It has been known and used in some form for over forty years, and probably longer, although in common with most other engineering accessories, its earlier forms



Heintz Trap.

were both crude and comparatively ineffective.

Up to twenty years ago the usual form of trap was the pot or bucket type which is still frequently used. Of these the Walworth trap was then probably the best known, at any rate in the manufacturing districts of the Eastern States and Canada. About that time the general dissatisfaction with the limited uses of this type of trap, drew the attention of a few inventive minds, and men like Littlefield, McDaniel, Wright and others began a new development that has placed the once despised steam-trap in an entirely new position in the steam engineering world.

The chief and fundamental function of the steam-trap is, as every engineer knows, to "trap" the water of condensation from steam-using apparatus, and the first necessary requisites of a steam trap are that it should allow this water to escape freely as fast as it forms and at the same time prevent any steam from passing the point at which the trap is placed. Every engineer knows that an accumulation of water, lying in pipes that are primarily intended for radiating the heat-units of steam, decreases immensely the efficiency of the apparatus. Moreover, there is an enormous difference in efficiency between merely draining the water and draining it promptly. The second point is of quite equal importance, as, if the trap allows steam to blow through, there might as well be no trap. However, in this connection the engineer must remember that steam-traps are frequently called upon to drain condensation under high pressure conditions where the water when it reaches the atmosphere and cools by expansion, gives off heavy vapor. He must judge carefully between live steam under pressure and the vapor of expansion, before condemning a trap for not holding back the steam.

Besides, there is another most important point to be considered. It is not desirable that a trap should hold back the water until it has become cooled off. The latent heat units in the condensation can probably be utilized in some way, and a trap should always discharge the water at almost the same temperature as that at which it receives it.

It is not possible in the space at the disposal of an article of this nature, to discuss every steam-trap that is sold in Canada to-day, and it is, therefore, necessary to confine this article to a general description of the four principal types in general use, taking up the outstanding features of each.

### Pot and Bucket Traps.

It is not necessary to go into all the details of construction of the pot-trap and the bucket trap. These are the types that are best known, owing to their being the oldest form of trap in present use. Their use is becoming more restricted owing to the fact that their capacity is not large, which is due to the small size of the interior valve-opening as compared with the inlet and outlet, and they are not suitable for the high pressures that are coming into more common use now. Their chief advantage lies in a very low first cost, and in that they occupy small floor space.

### Expansion Traps.

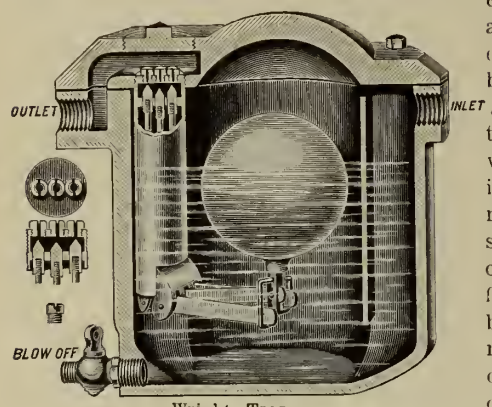
The expansion steam-trap, so called, is designed on the general principle that steam is hotter than water. The trap is set so that when the discharge opening comes into contact with steam, the expansion due to the high temperature closes the trap. Vice-versa as water accumulates in the trap, and cools off, the corresponding contraction opens the discharge and allows the condensation to escape until the steam once more reheats the trap. The "Hentz" trap is a well-known type of this trap, and the "Sullivan" trap made at Kingston, Ont., is also doing excellent work. This type of trap is used in many various forms on radiators of low-pressure and semi-vacuum heating systems, and it has the advantage of costing little and occupying a very small space. Its chief disadvantage is that it depends upon the principle of cooling the condensation before discharging it.

### Float-operated Traps.

This is the form of trap that is probably to-day in most general use in Canada. The water flowing into the trap raises a copper float which is attached to a lever. The lever in lifting opens either one or a series of valves which allow the water to discharge, and a water seal being maintained above the level of these valve openings the steam does not pass through them. The best known traps of this type are the "Wright," "Sheldon," "Anderson," and "McDaniel," although there are others made both in the United States and in Canada, such as the "Tackaberry" which has considerable vogue in the textile industry, and is the invention of a former resident of Cornwall, Ont., where he was an engineer in the employ of the Canadian Colored Cotton Mills Co.

Morehead Trap.

These traps are very reliable under low and medium pressures, and give good service where they are not overloaded. They are usually provided with a gauge-glass so that the engineer can see how they are working, and this feature is important. The "Wright" traps are made with valve openings of different size for low, medium and high pressures, and the same applies to the others. Their disadvantages are that under higher pressures (that is over 100 lbs.) the floats occasionally leak, and that the interior valve openings are usually so much smaller than the visible inlet and outlet openings, that it is difficult to judge the actual capacity of the traps under working conditions. Every trap of this type should be provided with a glass, as otherwise it is impossible to tell if they are working properly, without disconnecting the outlet and making a test.



Wright Trap.

### Tilting Traps.

The tilting type of steam-trap has only quite recently come into more general use in Canada. The original inventor of the tilting type trap is Frank Littlefield, of Nashua, N.H., who obtained his first patents about twenty years ago. The first Littlefield trap was re-baptized "Bundy" when it was marketed for the manufacturers by the Griffin Iron Co., of Jersey City, under their general trade mark. This trap is still made at Nashua, by the Nashua Machine Co., under Mr. Littlefield's supervision and is the prototype of all tilting traps. It is now marketed by the American Radiator Company's Bundy Department. More recently the Morehead Co., of Detroit and the Crane Company of Chicago, have also placed tilting traps on the market and the activities of these three companies have lately given much prominence to this style of steam trap. The water flowing into the bowl or receptacle of the trap fills this until the weight of water and bowl overcomes a check-weight placed on a lever. The bowl in dropping raises the valve-stem of the discharge valve, and is emptied by the pressure at the inlet through a siphon-pipe. When the bowl or receptacle is empty, the check-weight raises it into the filling position and at the same time closes the discharge valve.

The advantages of this type of trap are that its operation is visible and that the valve opening is the full size of the inlet and outlet. Owing to this opening, these traps are able to lift the condensation vertically two feet for every pound of pressure at the inlet, and it is also easier to determine the exact capacity of the trap. They cannot be flooded by a sudden rush of condensation, as these traps will remain under this condition in a discharging position with the valve wide open. They have no interior or hidden mechanism and are reliable under any working steam pressure. Their disadvantages are that they occupy considerable space both on the floor and vertically, and that they must be carefully installed to obtain the best results. Their weakest spot is the disc of the discharge valve which is easily cut by pipe-scale, core-sand or other dirt although the disc can be easily replaced if necessary. Piping has to be well cleaned before installing. These traps have also very occasionally to be repacked in the trunnions, but excepting on high pressures, 125 lbs. or over, this does not happen frequently. The Morehead and Crane-tilt traps are more complicated than the "Bundy" but their boiler return traps have some advantages when used on extreme high pressures of 175 lbs. or more, although this does not apply to the ordinary tank or separating traps.

### Return Traps.

Up to this point, the engineer will note that this article has been dealing entirely with tank or separating traps, which are designed to fill the primary conditions of separation and discharge.

The introduction of the tilting principle opened the way for using steam traps for other purposes and simplified one of the serious problems that has always confronted engineers, namely, how to deal with water of condensation economically when returned to the boiler room at a temperature above the boiling point. It is obvious theoretically and proven practically, that if condensation can be returned direct to the boilers above the evaporation point without losing its latent heat, that great economy must result as regards the quantity of fuel required to re-heat it to the boiler pressure. Unfortunately there is no pump that continuously handles boiling water, and particularly water over 220 degrees F., satisfactorily. The practice of cooling the returns by the addition of cold water has been proven to be wasteful, and the tilting trap is the only method by which water can be handled at these high temperatures economically. The engineer will note the name "Return" trap is really a misnomer, for it should really be called an "Equalizing" trap. If the water can be carried to a trap situated well above the waterline of the boilers, either by the pressure behind the returns, by gravity, or by lifting it to that point, and if the pressure in that trap can be equalized with the boiler pressure and an opening given between the trap discharge and the inside of the boilers, then the rest is merely a question of sufficient gravity to overcome the friction in the pipe between the two, and such check valves as may be necessary.

For instance, on the heating system of a mill the full boiler-pressure of 85-lbs. is carried, and the condensation comes back to the boiler room direct. When everything is well heated up, the temperature of the water at the discharge point is probably 300 degrees F. while that water is kept under pressure. It certainly is not economical to discharge this water into a hot-well or open heater, to allow it to reduce its temperature

Bundy Trap.

by expansion to 212 degrees or less, then to further cool it off in the pump cylinder, and finally to reheat it to 328 degrees F. On the other hand the saving is obvious if this water can be returned direct into the boiler after adding from 4 degrees to 6 degrees to its temperature while passing it through the equalizing trap.

The tilting trap can be utilized for various other purposes. Owing to its construction it is the cheapest and easiest method of pumping hot water from any one point to any other, its capacity being only limited by its size and by the available steam pressure at the trap. It uses only a fraction of the steam lost by the ordinary pump exhaust, it is automatic and has no appreciable up-keep cost. One type can also be used for removing water from vacuum automatically and discharging to atmosphere without breaking the vacuum.

**Suggestions.**

The engineer who requires a steam trap to do certain work, should consider the question very carefully with due regard to the conditions existing both in his boiler-room and at the point where the trap is to be located.

(1) The first point to be taken up is to determine the quantity of water which the trap is to take care of. This will naturally vary according to the nature of the apparatus to be drained. For instance, experience has shown that the average condensation ratio in steam coils used for heating buildings, when the rooms are at their normal temperature, is about 9 oz. of water per hour per square foot of radiating surface. In ordinary dry-room or kiln work, the condensation is about three times as rapid, giving about 27 oz. of water per hour per square foot, and in fan-stacks for indirect heating, where the air is brought into contact with the heating surfaces by means of forced draft, the condensation will be about 1 lb. of water per hour per each lineal foot of 1" pipe, or nearly 3 lbs. per square foot, and this where the air is being re-circulated from the building. Where air is drawn directly from the outside atmosphere in very cold weather, the condensation will sometimes run as high as 40 oz. of water per hour per lineal foot of 1" pipe. Again in dry-room work the quantity of water will vary according to the nature of the material being dried, heavier goods when wet producing more condensation than lighter materials. Piping used for heating water will produce a greater amount of condensation than almost any other apparatus.

A lye-pot used by a Railway Co. in their engine erecting shop about 12' x 12' and 10' deep containing 400' of 1½" pipe, produces a constant stream of condensation sufficient to fill a 1" pipe with 125 lbs. initial steam pressure. In this case all ordinary rules were of no value as when the lye was hot large iron truck bodies were being lowered into the vat to be cleaned and this reduced the temperature and increased the rate of condensation to such an extent that a trap had to be installed of double the capacity that would have been required had it been merely a question of heating the lye and then keeping it at an even temperature. Every individual case must be judged on its individual merits. If a doubt exists as to the quantity of water it is best to make a test by allowing the water to run into a barrel or other receptacle. It is also always best, and in fact imperative, to buy a trap that will take care of the maximum condition and not merely the average. Rapid condensation usually means that the apparatus is cold and is using most steam, and the more quickly it is drained the more quickly will it heat up and produce the average or minimum amount of water and the less steam it will require. A recent case may be stated of an acetic acid still in a chemical refinery, where the change to a trap of double the capacity cut off nearly 3 hours from the time of each stilling, enabled the superintendent to make two stillings per day, and at a cost of $40 doubled the capacity of the acetic acid distilling plant. Many similar cases might be cited to show the increase in efficiency due simply to proper and prompt removal of the condensation as formed.

(2) After having determined the approximate quantity of water, it is necessary to know the pressure available at the trap for its discharge. All advertised steam traps have what is known as a catalogue rating, that is, the manufacturer states that the trap will discharge a given quantity of water or drain a given amount of radiation. These figures are usually based upon a pressure of 50 lbs. at the trap. But they do not usually inform the prospective buyer what the trap will do at 5 lbs., at 15 lbs., or at 75 lbs., or at any other special pressure. Now it is self-evident that with 50 lbs. pressure much more water can be forced through a given size of hole than with 10 lbs. and considerably less than with 80 lbs. In other words, where 1,000 square feet of radiation have to be drained, a smaller trap will do the work with 80 lbs. pressure, and a much larger trap will be needed if the initial pressure is only 10 lbs. Moreover, it is also necessary to allow for a drop in pressure, due to condensation in the piping. On a fan stack containing 4,000 feet of 1-in. pipe, where the steam is supplied at 60 lbs., when the weather is cold, and condensation is rapid, the pressure at the trap will sometimes drop as low as 30 lbs., and a case actually exists where steam at 80 lbs. turned into a small hot-water heater full of cold water results in a vacuum at the outlet that is not overcome for nearly three minutes. These are extreme cases, but similar conditions exist in some degree in nearly every class of steam-using apparatus, and must be allowed for in calculating the size of steam trap required. Should it be advisable or more convenient to have the trap discharge above its own level, a deduction must be made of 1 lb. for every 2 feet lift and allowed for in deciding the available pressure. A trap discharging with 50 lbs. pressure and lifting the water 30 feet above its own level, has only in reality 35 lbs. available as a discharging force.

(3) If the traps are taking condensation from apparatus under medium and high pressures (25 to 200 lbs.) and are discharging the water at an approximately equally high temperature, the engineer should consider whether the quantity of water is sufficiently great to warrant his keeping it under pressure and returning it direct into the boilers through an equalizing or return trap. It is not a difficult matter to make this calculation, and the usual formula, that 12 deg. increase in the temperature of the feed water equals a direct saving of 1 per cent. of the total fuel, will give a good idea as to whether the saving will pay for the additional traps within such a reasonable time as to make the investment profitable to the owner of the plant.

**Hints as to Buying.**

When a trap salesman calls upon the engineer, he naturally brings out all the strong points of his trap and glosses over the weak ones. For instance, it is a common practice to tell the engineer, if the outlet of his apparatus is 1½ in., that the salesman's 1½-in. trap will do the work. This is frequently done where the conditions are such that that particular trap could not possibly do the work owing to the fact that its interior or discharge valve openings are not sufficiently large to allow the necessary quantity of water to pass. The engineer should know all details of the trap he buys—not merely the size of the inlet and outlet, but also its interior as well as the exterior mechanism and the area of the discharge valves, so that he may buy the trap not on its catalogue rating, but to suit the actual conditions to be met. More steam traps give dissatisfaction from this cause than from any other, and the engineer should remember that a trap that is too small to meet the condition, is one of the most wasteful things he can purchase. The efficiency of much good machinery is reduced by one-half through defective and improper trap-

ping. The writer has frequently seen pressures of 60 to 80 lbs. rendered necessary to obtain a temperature that could easily have been maintained with 20 to 25 lbs., had the apparatus been properly and promptly drained. To buy a steam trap of insufficient capacity is merely a throwing away of good money. Many times a saving of $10 to $50 in the cost of a trap will cause a loss to the owners of hundreds of dollars annually through decreasing the output of a given machine.

Nowadays, every reputable manufacturer issues catalogues and gives full information regarding his products. The engineer should not leave himself in the hands of any one salesman, unless he has had such previous experience with that particular salesman as has justified his confidence by actual results. In steam trap work theory alone is worth less than nothing The only experience that is worth anything can only be obtained by actual contact with a great variety of conditions Some of the leading steam trap manufacturers maintain special engineering staffs that do nothing else but solve problems relating to condensation Let the engineer write

Fig. 1.—Automatic Feed Water Regulator.

his difficulties to one or more of these large concerns, and by the tenor of the replies he will soon discover which is the best doctor in his case. The handling of condensation is a special branch of engineering in itself, and an expert of wide practical experience can frequently make suggestions which result in a solution of difficulties that looked very formidable to the man in charge.

Get all the available catalogues and study the steam trap in the light of what you know. It is an interesting study in these days, when the profits of many manufacturing firms depend almost entirely upon the savings to be made in production costs. Coal costs money. Every ton of coal saved represents a goodly annual percentage on $100, and steam traps are "coal-savers" and "output-increasers," if bought and applied with intelligence.

---

## HOW AN AUTOMATIC FEED WATER REGULATOR OVERCAME DIFFICULTIES IN THE POWER HOUSE.

The Helena Costume Co., London, have over sixty customers to whom they supply power, as well as being large consumers themselves. They found that their load varied from 25 h.p. to 200 h.p., and it was very hard to regulate the supply of water to the boilers, under these conditions, owing to the load coming on and off very suddenly.

To overcome the difficulties, the Automatic Feed & Regulator Co., 117 Masonic Temple, London, installed the automatic feed water regulator as shown in Fig. 1. This regulator is shown in section in Fig. 2. It has been found that

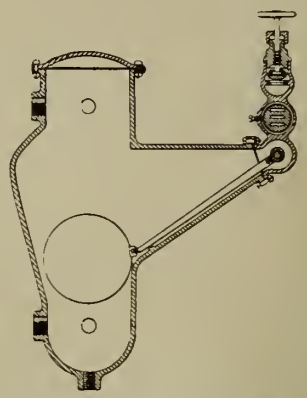


Fig. 2.—Section Feed Water Regulator.

the fireman saves considerable time which he can devote to other things. Fig. 3 shows an automatic pump governor used in connection with the regulators, this pump controlling the pump in accordance

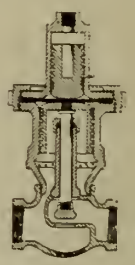


Fig. 3.—Automatic Pump Governor.

with the need of water. The Helena Costume Co. have found that this governor will keep the water the same level in two boilers being operated at the same time, and connecting with two pumps that work individually. It has been found that the saving in water is very considerable.

---

The danger of explosion of mixtures of air and combustible dust is well known. Explosions of this character occur in flour mills and frequently in coal mines. Mixtures of air and aluminium powder are very liable to explosion. The combustion of aluminium powder produces a very high temperature. On this fact is based the process of autogenous welding of iron rails which is known as aluminothermy. Recently, in a factory near Nuremberg, where a metallic surface is given to paper by means of aluminium powder, the breaking of the globe of an inclosed arc lamp (Liliput) caused an explosion which killed two men and wounded several others.—Scientific American.

# The Various Types of Refrigerating Machines

**Joseph H. Hart, in Cassier's Magazine, Explains how Exhaust Steam may be Employed in the Evaporation of Ammonia.**

As a general statement we can say that all refrigerating machines may be classified into three groups: those employing air as a refrigerant; those employing the mechanical phenomena of absorption and solution of ammonia by water; and those using liquifiable gas.

There is one other type generally recognized as thoroughly inefficient which is in existence to-day in some minor plants, viz., the vacuum process. In this water vapor is withdrawn rapidly from the space above the surface of the water and the production of new vapor, which is in turn removed, absorbs the heat of liquefaction from the water, thus producing ice. It is in reality a subhead under the liquefiable gas machine in which the liquefaction is of minor significance and unnecessary. However, this machine exists to-day only in small isolated units and the remarkable mechanical inefficiency of the removal of the water vapor is responsible for its present position.

### The Air Machine.

Now the air machine is clean and odorless and is somewhat in use on shipboard. It utilizes the process known as balanced expansion, whereby the air is cooled by doing work in a cylinder. Its size, weight and cost, and large consumption of power are serious drawbacks to its wider use and it is now recognized that its field is limited to places where the use of other types is prohibited.

The absorption machine has a rather complicated mechanism. There are no moving parts except a small slow-speed pump and it possesses a distinct advantage on this account. Its agent is ammonia and it was generally regarded up to about the year 1895 as an extremely inefficient process.

The liquefiable gas machine was considered the most efficient, the simplest, and most convenient. A gas was liquefied by mechanical compression, followed by cooling, and this liquid was then allowed to evaporate and absorb its latent heat of liquefaction from surrounding bodies and the process was made continuous. Ammonia, sulphur dioxide, ether, methylchloride, gasolene and carbon dioxide, and any one of an even larger number of what are known as volatile liquids have been used. From theoretical considerations and practical details combined, it has been shown conclusively that ammonia is probably the best substance for the conveyance of heat in refrigeration and the majority of compression machines to-day utilize this material, although carbon dioxide, on account of its physical properties and diminished cost, has replaced it to a certain extent in some of the smaller units.

### The Absorption Process.

The absorption machine, so-called, which utilized water in conjunction with ammonia gas, was the first practical refrigerating machine; but later came into considerable disrepute on account of its remarkable inefficiency. The gas is produced from the aqua ammonia by steam coils in a generator somewhat similar in construction to the modern boiler. The pressure was increased by means of heat until the gas could be liquefied with cold water and it was then evaporated in a manner identical to that of the ammonia compression type. The expanded gas instead of being conveyed into a compressor as in the latter system was absorbed by cold water or weak aqua ammonia. This system requires five distinct units: the generator, where the gas is produced; the dehydrator, where the excess water vapor carried over by the gas is condensed and removed; the condenser, which consists of pipes having cold water flowing over them and in which the gas is changed to ammonia liquid; the expansion coil or shell cooler, in which the refrigeration is produced; and the absorber, which absorbs the gas back into the weak aqua ammonia, completes the process; Further, an ammonia pump must be installed to force this liquid back into the generator, thus making the process continuous. The compression system, on the other hand, utilizes simply a compressor and condenser and the refrigerating apparatus or shell cooler. This mechanical compression type was formerly superior, although it depends on the operation of a compressor which is mechanically of low efficiency. Both types of machines, however, are dependent for their efficiency upon design to an extent which was not realized until recently and the situation exists to-day that the absorption system is the superior in many ways when used in large units.

### Value of Design.

As an illustration of this latter point it can be cited that the absorption system has its efficiency limited directly by the action of the dehydrator. If water vapor is carried over with the gas and not separated, it condenses in the condenser in the production of liquid ammonia and combines there directly with it, forming strong aqua ammonia; the refrigerating power of the ammonia being counterbalanced by the heat of combination at this point. Thus the entire problem in the absorption system depends upon the design of the generator and its efficiency in producing rapidly comparatively pure ammonia gas without water vapor and upon the efficiency of the dehydrator in removing the residue of the water vapor before it becomes objectionable. The design of the absorption system was not fully studied until within the last decade. Both types of machine depend absolutely for their efficiency on their design. An absorption plant may operate with the production of no refrigeration and a compression plant may do the same, the result being due to faulty design in both cases.

### How Absorption Works.

The absorption machines employ the heat in the steam for the production of the ammonia gas from the aqua ammonia. It thus utilizes the latent heat of vaporization of steam, and high-pressure superheated steam increases the efficiency but slightly. A compression type utilizes the expansive force of steam only and hence superheated compound condensing engines are the rule in large instalations of this type. Thus we come to the anomalous condition that the absorption machine can utilize exhaust steam very efficiently, whereas the compression plant has its best efficiency with high-pressure superheated steam, and does not utilize the heat of the exhaust at all. The claim is often made that the absorption machine requires more heat in its operation than the compression plant, and while this is true, when the quantity of heat taken from the boiler is considered the absorption system is much superior. Thus in large units—in the production of ice, for example—a compression plant operates generally on an 8 to 1 basis; that is, 8 tons of ice produced to 1 ton of coal consumed. An absorption system under the same conditions can operate on an 11 to 1 basis, whereas a combination plant of the same total capacity for compression and for absorption, the exhaust steam from the compressor operating the absorption system will operate on a 14 to 1 basis. These figures in general have a 50 per cent. range of applicability, depending upon maintenance of plant and method of operation; but there is no doubt, in large units of 100 tons' capacity or more, that the absorption system, or better, a combination plant, is much superior. This is in complete contradiction to the generally accepted opinion ten years ago, and is due to improvement in design of the absorption system whereby the exhaust steam can be utilized efficiently and in which heat waste has been comparatively eliminated.

### A Remarkable Condition.

This brings us to a remarkable condition in the engineering field. It shows a

further application of the utilization of exhaust steam never before seriously considered. Exhaust steam has been used generally for heating purposes and in some isolated cases for drying various materials. Its application to mechanical refrigeration in power-plant production has progressed to a certain stage. It has been generally recognized that such units as the lighting or trolley systems have excess loads in the morning and evening. Formerly this was taken care of by storage batteries, but their rapid deterioration and general cost of maintenance was such that it has been found preferable to operate a full-size plant for the load at maximum. This is due partly to the increased efficiency of large plants and to the necessity of a choice between two evils. This latter situation presented a large excess power available at slack time and this excess has in some cases been sold to small refrigeration consumers operating their own plants. Mechanical refrigeration possesses this further advantage in this field. It can be operated intermittently. Thus by the use of a large brine storage tank refrigeration can be produced in the brine and kept there for long periods of inactivity with small waste and utilized when wanted. Thus the power plant in its development has aided the development of a large number of small unit refrigerating systems by the furnishing of sufficient power at minimum cost at irregular intervals.

### Mechanical Refrigeration.

Further, owing to the ability of mechanical refrigeration to operate intermittently, and in reality to take the place of the storage battery in the storage of energy, it has found a place in the modern plant. Thus many small trolley and lighting systems operate a refrigerating or cold storage plant as well. The excess current being turned into refrigeration when not needed and the cold brine carrying this system over the inactive period when power was needed along other lines. This has proved extremely efficient, and in many of the smaller cities such plants are in active operation.

The advent of the absorption system with its remarkable increase in efficiency threatens to produce a change in the present conditions. Modern power plants in large units require complicated prime movers using superheated steam and generally of the compound condensing type whose cost of maintenance and high first cost is often almost prohibitory. The absorption system cannot use efficiently high-pressure superheated steam. The compression plant itself is inefficient in the production of refrigeration. Hence, it, in turn, will be displaced for large units, and we shall have the rather anomalous condition of large refrigerating concerns with excess power for sale, using simply plain slide-valve engines of low efficiency and large steam consumption. Such a plant could sell power as a by-product in quantities and at prices such that the ordinary unit in this field could not compete. Further, the modern power plant has an additional by-product available in the utilization of its exhaust steam in the production of mechanical refrigeration. The inter-relations between these two engineering developments are at their inception and time only can develop the exact situation. However, conditions are such at present as to point almost conclusively to a radical change in their inter-relations and a complete innovation in the production of power.

## HEATING FEED WATER.

Before evaporation can commence, the feed water furnished to steam boilers has to be heated from the normal temperature to that of the steam, and this ordinarily at the expense of the fuel which should be utilized in making steam. The temperature of steam at 75 lbs. gauge pressure is 320 degrees Fah., and if we take 60 degrees Fah. as the average temperature of the feed, we have to add 260 heat units per pound of water evaporated to raise it to the steam temperature, and as it takes 1,151 heat units to evaporate a pound of water from 60 degrees Fah. into 75 lb. pressure steam, this represents 22.5 per cent. of the fuel. Any heat therefore which can be imparted to the feed water before it reaches the boiler is so much saved, not only in cost of fuel, but in capacity of the boiler.

There are two sources of waste heat available for feed-heating purposes—the exhaust steam and chimney gases. By the former water may be heated to 200 degrees, or possibly to 210 degrees, in a well proportioned heater.

The gases going to the chimney carry off a considerable percentage of the calorific value of the fuel, and in the most economic boiler this cannot be reduced below 12 per cent. Some proportion of this is always available for heating the feed-water, by what are known as economisers, and frequently it may be raised nearly to the temperature of high pressure steam, making a saving in some instances of 20 per cent. The more wasteful the boiler, the greater the benefit of the economiser, but for large plants it is always a valuable adjunct. In small non-condensing plants the exhaust steam from the engine may be utilized to heat the feed-water to good advantage.—From Treatise "Steam," issued by Babcock & Wilcox.

---

From an article in the Engineering Magazine, dealing with the heating equipment, it may be asserted that it is possible to obtain a degree of regulation with steam by varying the pressure; but the best results obtainable by such a method depend on the use of high-pressure steam direct from the boiler, and even then it is not advisable to use a greater pressure than 30 pounds in cast-iron radiators. This would give an increase in the temperature of the steam from 212 degrees to 271 degrees, and if exhaust steam is used, would involve the increase of the back pressure on the engines.

**FEED WATER, SAVING OF FUEL BY HEATING, IN PER CENT.**

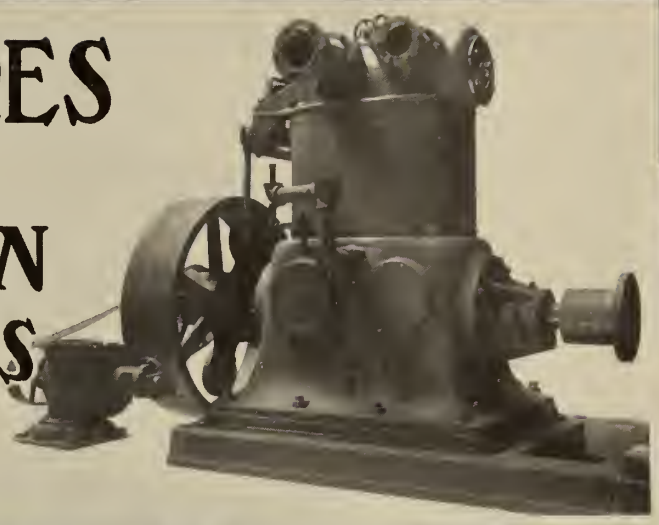
(Steam at 160 lbs. about 11 Atmos. Gauge Pressure.)

| Initial Temp. of Feed Water. Fahr. | Final Temperature of Feed Water. | | | | | | | Initial Temp. of Feed Water. Cent. |
|---|---|---|---|---|---|---|---|---|
| | 120° F | 140° F | 160° F | 180° F | 200° F | 250° F | 300° F | |
| 32° | 7·37 | 9·04 | 10·71 | 12·38 | 14·06 | 18·24 | 22·43 | 0° |
| 35 | 7·13 | 8·81 | 10·49 | 12·16 | 13·85 | 18·03 | 22·23 | 1·7 |
| 40 | 6·74 | 8·42 | 10·11 | 11·79 | 13·48 | 17·68 | 21·90 | 4·4 |
| 45 | 6·34 | 8·04 | 9·73 | 11·42 | 13·11 | 17·34 | 21·57 | 7·2 |
| 50 | 5·95 | 7·65 | 9·34 | 11·04 | 12·74 | 16·99 | 21·24 | 10° |
| 55 | 5·55 | 7·25 | 8·96 | 10·66 | 12·37 | 16·64 | 20·90 | 12·8 |
| 60 | 5·14 | 6·85 | 8·57 | 10·28 | 11·99 | 16·28 | 20·56 | 15·6 |
| 65 | 4·73 | 6·45 | 8·17 | 9·90 | 11·62 | 15·92 | 20·22 | 18·3 |
| 70 | 4·32 | 6·05 | 7·78 | 9·51 | 11·23 | 15·56 | 19·88 | 21·1 |
| 75 | 3·90 | 5·64 | 7·38 | 9·11 | 10·85 | 15·18 | 19·53 | 23·9 |
| 80 | 3·49 | 5·23 | 6·97 | 8·71 | 10·46 | 14·82 | 19·18 | 26·7 |
| 85 | 3·06 | 4·81 | 6·57 | 8·32 | 10·07 | 14·45 | 18·83 | 29·4 |
| 90 | 2·64 | 4·40 | 6·16 | 7·91 | 9·69 | 14·07 | 18·46 | 32·2 |
| 95 | 2·21 | 3·97 | 5·74 | 7·51 | 9·27 | 13·69 | 18·11 | 35° |
| 100 | 1·77 | 3·55 | 5·32 | 7·08 | 8·87 | 13·31 | 17·75 | 37·8 |
| 110 | ·89 | 2·68 | 4·47 | 6·27 | 8·06 | 12·53 | 17·01 | 43·3 |
| 120 | 0 | 1·81 | 3·61 | 5·42 | 7·22 | 11·75 | 16·26 | 48·9 |
| 130 | — | 0·91 | 2·73 | 4·56 | 6·38 | 10·94 | 15·50 | 54·4 |
| 140 | — | 0 | 1·84 | 3·68 | 5·52 | 10·12 | 14·72 | 60° |
| 150 | — | — | 0·93 | 2·78 | 4·64 | 9·29 | 13·93 | 65·6 |
| 160 | — | — | 0 | 1·87 | 3·75 | 8·43 | 13·12 | 71·1 |
| 170 | — | — | — | 0·95 | 2·84 | 7·57 | 12·30 | 76·7 |
| 180 | — | — | — | 0 | 1·91 | 6·68 | 11·46 | 82·2 |
| 190 | — | — | — | — | 0·96 | 5·78 | 10·61 | 87·8 |
| 200 | — | — | — | — | 0 | 4·87 | 9·74 | 93·3 |
| | 48·9° C | 60° C | 71·1° C | 82·2° C | 93·3° C | 121·1° C | 148·9° C | |

## PERSONAL.

R. Boronow, of the Engineering Equipment & Supply Co., Montreal returned from Europe, where he investigated the latest developments in flame arc lamps and other new apparatus. He reports that flame arc lamps have been widely adopted for street illumination and especially for the lighting of railway stations and yards. He has completed arrangements with a number of important Continental firms which will enable his company to introduce some entirely new apparatus to the Canadian market.

# SOME FEATURES *in the* CONSIDERATION OF CONDENSERS



By F.C.D.WILKES, B.Sc.

Although in steam engineering practice the condenser is as old as the engine itself, it has, until recently, received far less consideration and has usually been treated as an auxiliary, the reliability and efficiency of which had but little bearing upon the efficiency of the plant as a whole. With the coming of the steam turbine and the demand for higher economies the importance of the condensing apparatus has become more clearly apparent and it now holds its rightful place as one of the important parts of the steam power plant.

There is a two-fold object in using a condenser in connection with a steam engine: to increase the capacity or to reduce the steam consumption per horse power if the load and other conditions remain the same. The use of a condenser is to remove as much as possible of the atmospheric pressure from the exhausting side of the piston, which action increases the mean effective pressure on the other side. The condenser does this by creating a partial vacuum on the exhaust side. If an engine were running, non-condensing, with a mean effective pressure in the cylinder of 35 pounds per square inch and 10 pounds is added by using a condenser the mean effective pressure would be increased, theoretically, to 45 pounds increasing the capacity of the engine. But if the work done is to remain the same, the steam in the cylinder may be cut off earlier in the stroke keeping the M.e.f. still at 35 pounds and thus effect a saving in steam. One point to be noted in this connection is that the most economical load for a non-condensing engine is not the most economical if the same engine is run non-condensing although the steam consumption will no doubt be less. If an economy is to be effected the cylinder of a condensing engine should be larger than that of a non-condensing unit and the steam is usually supplied at a lower pressure.

As noted above the advent of the steam turbine has increased the importance of the condenser for, although it is not always advantageous to use a condenser with a reciprocating engine, it is essential where a steam turbine is used. The cost of condensing water is a big item in the consideration of a condenser installation. Also the load factor (i.e. the number of horse-power hours per annum —8760 x h.p.) may be so small as to make it impracticable to instal a condenser even though an unlimited supply of condensing water may be available. On the other hand with a high load factor a condenser will effect an economy in fuel that will more than pay for the increased capital charge, more complicated plant and even an expensive water cooling apparatus.

In most cases the use of a condensing engine will result in a saving of from 25 to 30 per cent. in the steam required for an engine running non-condensing. This saving is not a net gain as steam is required to drive the air pump. This amount usually runs from 1 to 5 per cent. of the steam used by the main engines, depending of course on the size of the latter. This steam may also be utilized to heat the feed water, in an auxiliary feed-water heater which is generally used when there is a condenser installed, and so will not represent a dead loss. The water in this is heated by the exhaust from all the auxiliary engines such as boiler and air pumps, fan engines, etc., hence the name auxiliary heater. When there is a feed water heater in the main exhaust pipe (generally called a primary heater) the highest obtainable temperature is about 108 or 110 degrees while in an auxiliary heater (secondary heater) as high as 165 or 170 degrees in a large plant may be obtained and even higher in a small plant. The reason for the low temperature in the primary heater is, of course, due to the low temperature of the steam corresponding to the vacuum in the condenser. With non-condensing engines, as high as 205 degrees may be obtained in the feed water so that with engines of this type the saving due to the higher feed water temperature partly counter-balances the saving in coal due to a condenser.

Usually it does not pay to install a condensing plant when the resultant economy will be less than 10 per cent. on the cost of such plant because it would require about this amount to cover the additional running expenses and depreciation.

### Types of Condensers.

There are three general classes into which condensers may be divided, these are known as the syphon, jet and surface condensers. The type known as evaporative condensers may be said to belong to the surface class while the jet consensers are divided into the following types: parallel flow jet; counter-current jet; barometric jet.

The jet and surface condensers require an air pump to operate them and are called direct connected or independent according to whether they are belted or direct connected to the main engine, or have an independent steam cylinder or electric motor. With stationary engines the independent type has almost wholly replaced the direct connected, owing to the large advantage gained due to the flexibility of an outfit of this kind which may be run at any speed and to any load on the main engine. At sea, however, the direct connected type can still be used advantageously as the load is always more or less stationary.

### Surface Condensers.

In a surface condenser the circulating water does not come in direct contact with the exhaust steam, but circulates through a large number of small brass or copper tubes fixed into end plates. The steam comes in contact with the outside of these tubes and is condensed. The whole is surrounded by a shell usually of cast iron.

The most efficient arrangement is that in which the circulating water enters the tubes at the point of minimum temperature and discharges at the point where the temperature is at a maximum. This is known as the counter-current principle and is being used and elaborated on in some of the most recent makes of condensers.

The surface condenser is most generally used where the available condensing water would not do for use in the boilers. The condensed steam is used over and over again until it becomes too oily at which time it is replaced by fresh water. As oil causes a good deal of trouble in boilers this point has been the stumbling block of many a power plant owner when contemplating the adoption of surface condensers. However, this trouble may be almost entirely eliminated at only a slight additional cost by the use of proper filters. The construction of these filters involves the use of sand, excelsior, cloth, sawdust or any other good filter, and with proper care they give very satisfactory results.

The condenser is placed so that the

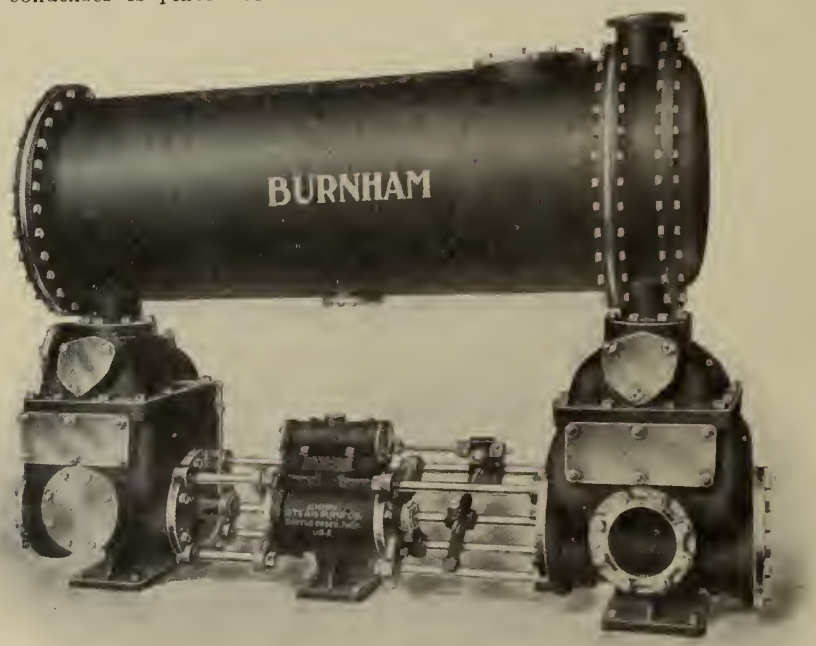



Fig. 1.—Burnham Surface Condenser 8½ x 9 x 10.

condensed steam runs by gravity to the air pumps by which it is removed to retain the vacuum. No circulating pump is needed if the cooling water is furnished under pressure, but if not the circulating pump may be driven by the same cylinder as the air pump. Usually the air and circulating pumps are in line with the steam cylinders and the condenser is overhead, the whole being supported on the same base. Fig. 1 shows the Burnham condenser mounted in this manner.

In the evaporative condenser the exhaust steam is led through a series of pipes over which the cooling water is allowed to trickle. These pipes are in the open air, being arranged so as to give as large a radiating surface as possible. Sometimes a fan is used to create a draft making the evaporation more rapid. The pipes should be of cast iron if possible.

### Jet Condensers.

Generally speaking a jet condenser consists of a pear-shaped chamber into which the injection or condensing water enters at the top, mingling with and condensing the steam which enters at the side near the top. In the parallel flow type the steam and water both flow in the same direction and the one pump handles both.

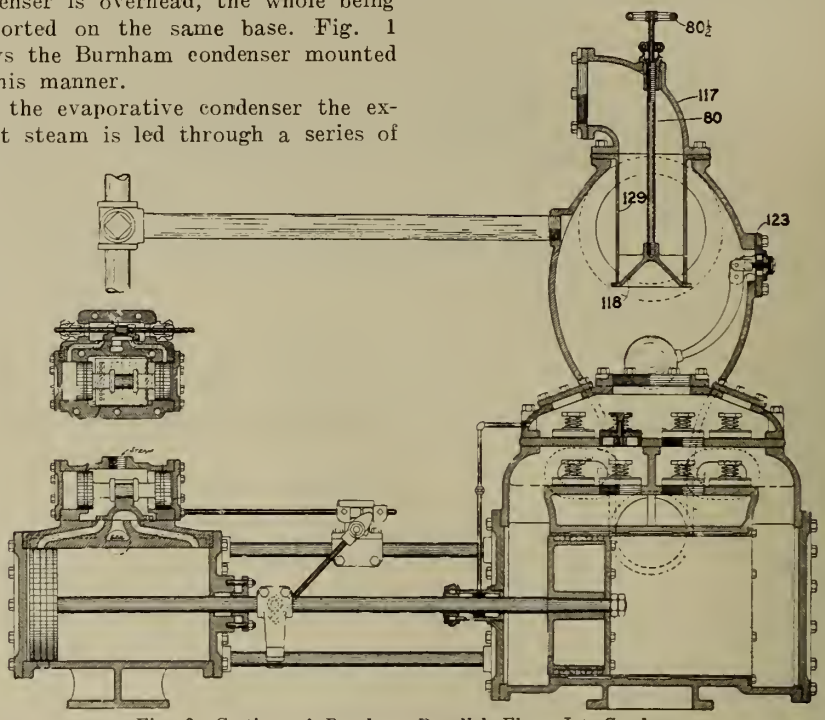



Fig. 2.—Section of Burnham Parallel Flow Jet Condenser.

Fig. 2 shows a cross section of a Burnham independent air pump and jet condenser manufactured in Canada by Darling Bros., Montreal. The injection water enters through the elbow 117 and the spray is regulated by the spray valve 118, through the medium of the hand wheel 80½ and valve stem 80. The part 123 is the vacuum breaker and 129 is called the spray pipe. The exhaust steam enters at the back and there is also an exhaust connection with the steam end.

In the counter current jet condensers the injection water enters at the top but the steam comes in at a point near where the discharge takes place. The injection water passes over a series of baffle plates which breaks it up and thoroughly mixes it with the steam.

The barometric or siphon jet is so called because it uses the barometric pressure or siphon action and eliminates the use of an air pump. The height above the hot well at which the condenser must be placed is determined by the amount of vacuum desired. It depends upon the fact that a heighth of 27.68 inches is required for every pound per square inch below atmospheric pressure or 34 feet for 14.7 lbs. per square inch.

Fig. 4 shows a Tomlinson barometric condenser as supplied by the Allis-Chalmers-Bullock Co., and which is a

very simple and effective apparatus. Steam enters at the top. The injection water enters at the side and flows over the serrated top and down into the steam and water combining chamber where the steam is condensed and is carried down through the contracted throat and tail pipe to the hot well. By contracting the neck as shown (sometimes called the ejector nozzle) sufficient velocity is given the water in falling to the hot well to maintain a siphon-like action that draws the steam from the exhaust pipe and causes a vacuum to exist in it, hence the name siphon condenser.

In the condenser shown in Fig. 4 the water and air combining chamber is provided with slots through the sides which communicate with a chamber surrounding it and to this chamber is attached an overflow pipe having its end sealed in the hot well. The object of this arrangement is to eliminate any danger of the condenser becoming flooded and causing an engine wreck should more water accumulate than the tail pipe can take care of. Fig. 5 shows the outside appearance of this type of condenser.

Fig. 6 shows a barometric condenser of the counter current type. This is a Tomlinson, type "B." In this the umbrella located just below the overflow tail pipe is so shaped that it causes the water to be thrown out to the side thereby forming a water seal between the discharge chamber and the condensing chamber, which prevents the air from returning from the former to the latter. The air which comes in with the exhaust steam and injection water passes up to the top of the condenser. Here it is drawn out by the dry air pump or down through the equalizing pipe through the nozzle where it is extracted by the action of the water flowing down the main tail pipe.

Fig. 7 is a section of a Worthington central jet condenser, called central be-

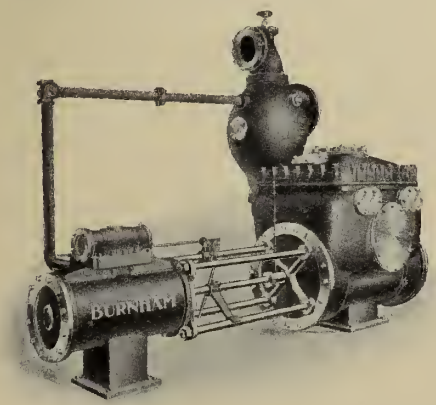



Fig. 3.—Burnham Parallel Flow Jet Condenser.

cause it is of often used to condense the steam of more than one engine. It is a modification of the siphon type, but the cone is considerably larger. The contracted neck has been eliminated to give an unrestricted fall to the water, lessening the chances of the exhaust pipe being flooded. The spray is controlled by an adjustable nozzle and there is an air pipe leading from the cone to a dry vacuum pump to assist in maintaining the vacuum. The air is led through a cooler which reduces the volume and gives the pump less work to do.

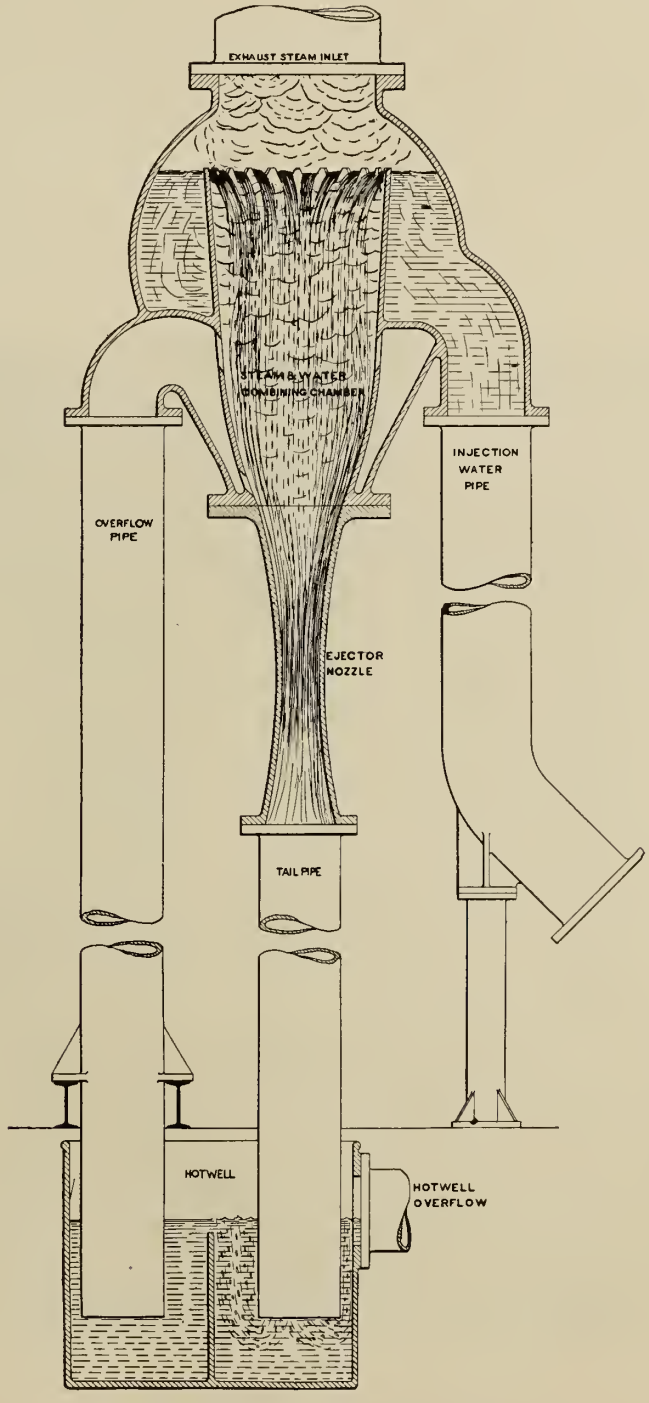



Fig. 4.—Section Tomlinson Barometric Condenser.

### Cooling Towers.

These consist of apparatus for artificially cooling the condensing water. Their development has made practical the use of condensers in plants where the supply of injection water is small and when condensers would be impractical without them. The operation of a cooling tower brings the water to the top of the tower and allows it to trickle down over mats or tiles while a current of air passes up through it. The air is generally forced up by the use of a small steam or electricity driven fan. Broadly considered, the air becomes the condensing medium in the place of cold water and on account of its general distribution the towers may be located anywhere about the engine room either on the floor or on the roof.

Fig. 8 is a drawing of a typical

Worthington cooling tower installation showing the connections when the tower is placed on the ground outside the engine room. These towers are also placed on the roof. When the towers are thus elevated, it is necessary to pump the condensing water from the condenser to the tower, but this power is partly counterbalanced in surface and low level jet condensers by the fall of water from the subsiding tank to the condenser. The type shown consists of a cylindrical steel shell open at the top. The filling of the tower consists of layers of cylindrical tubular tiling, which rest on a grating suspended by a brick lining wall. The heated discharged water from the condenser enters the tower at the side and passes up to the top through a central pipe. Here it is delivered upon the top layer of tiling and distributed over the cross section of the tower by being delivered through jets in four pipes which rotate on the same principle as a lawn sprinkler. The cooled water falls into the subsiding tank at the bottom and from thence is drawn into the condenser to perform condensation again.

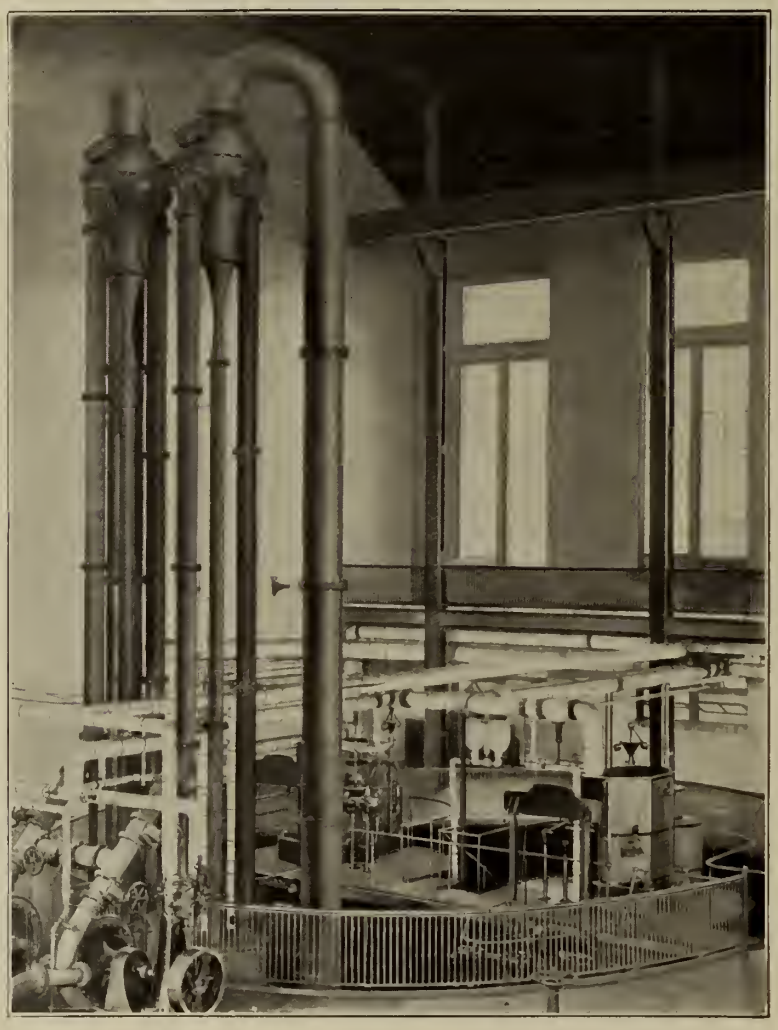


Fig. 5.- General View Tomlinson Borometric Condenser.

The use of cooling towers results in a loss of from about 10 to 15 per cent. in the circulating water, but this is more than made up, with jet condensers, by the discharge from the air pump of the condensed steam.

### Condensing Water.

Liberal allowances should be made in figuring the amount of condensing water required and the amount of steam used by the engine when working at maximum load should be taken into consideration. If the water is to be used over and over again, as for instance with cooling towers, there is an inevitable increase in the temperature of the injection water and therefore each pound is less able to absorb heat and consequently a larger amount is required.

The amount of water required to fully condense the exhaust steam of an engine is dependent upon two conditions—the total heat and weight of the steam, and the temperature of the injection water. With the temperature of the latter at about 70 degrees Fahr., it usually takes from 20 to 30 times the amount of feed water to condense the exhaust steam and maintain a vacuum of 26 inches. The injection water should be as cold as possible as its value decreases very rapidly with rise in temperature. For instance, where 30 times the feed water is required at 80 F., it requires 43 times at 90 deg. F., to condense the same amount of steam, other conditions remaining the same.

The amount of condensing water needed to condense one pound of exhaust steam is found by the use of steam tables and the following formula:

$$W = \frac{H - h}{T - t} \text{ where}$$

H equals heat in one pound of water at pressure exhaust valve begins to open.

(h) equals heat in one pound of water at temperature of discharge.

T equals temperatare of injection water.

(t) equals temperature of discharge.

### Size of Condensers.

Here again very liberal allowances should be made in computing the size of condenser needed. In surface condensers it has been found that an allowance of one square foot of surface of brass or copper tubes for every 10 to 12 pounds of water condensed per hour is sufficient for ordinary conditions. The tubes are generally solid drawn brass tubes and vary from half an inch in diameter in small short condensers, to one inch in large condensers with long tubes. The size can be determined, or at least checked, by the fact that the velocity of flow of water through them should average about 550 feet per minute.

When the air pump used with a surface condenser is a horizontal double acting one its displacement should be about 20 times the volume of the steam condensed, while 15 times the volume of steam condensed is sufficient displacement if the pump is of the vertical single acting type. This is a smaller quantity in the vertical type than in the horizontal as the air has a less detrimental effect.

The displacement of a horizontal double acting pump is found by multiplying the length of the stroke (inches) by the area of the piston (square inches) by the number of double strokes per minute. The size of air-pump necessary to accompany any condenser outfit may be easily computed by referring to catalogs of the makers wherein is contained data relating to the pumps such as stroke, diameter of cylinder and most economical speed.

In the jet condenser the pump not only has to remove the condensed steam but also has to handle the injection water with the air that is held therein

and also the air that finds its way into the exhaust either from the boiler or through leaks in the exhaust pipe, condenser, etc. On account of this air the displacement of the air pump, if it is a horizontal double acting one, should be double the volume per minute of the injection water, which volume has been found as explained earlier in this article. The displacement of a vertical single acting pump should be about 50 per cent. of the volume per minute of the injection water.

### Placing the Condenser.

This is an important consideration. One of the conditions which should be carefully avoided is that one in which a water pocket is formed in the exhaust pipe between the engine and condenser. This occurs in an installation in which the condenser is on the same floor as the engine. In these cases the exhaust pipe drops from the engine for a distance, then horizontally and up to condenser. It is impossible to trap this pipe as it is under a vacuum, so, to avoid any danger of this water gathering and getting back to the cylinder causing a wreck, all condensers of the low level jet and surface type should be lower than the engines they serve. The exhaust pipe should be at least absolutely horizontal, but preferably a direct drop to the condenser, as short as practical, and of very generous proportions. As an air leak, though small, will have a detrimental effect on the vacuum and efficiency of the engine, it is essential that the exhaust piping should have flanged fittings carefully machined and put together.

The location of the source of supply of the injection water is a point to be considered also. As it is not considered good practice to try to lift the injection water more than 20 feet, the condenser sometimes has to be on a much lower level than the engine, so as to be near the source of supply. If this source is some distance from the power house the water should be run to a well and the injection pipe led to this well. Perhaps the most frequent cause of condenser troubles is the fact that there are leaks in the suction pipe. This end, therefore, should be carefully assembled and tested for any air leaks as often as consistent.

### Choosing the Condenser.

Naturally the ideal condenser is that one in which the water in the hot well is at the highest obtainable temperature and the amount of condensing water is at a minimum. This occurs when the condensing water attains the same temperature as the steam in the condenser. It would appear then that the most efficient condenser would be of the type in which the condensing water comes in direct contact with the exhaust steam and there is no occasion for transmitting the heat through metal surfaces.

The difference in temperature between the steam and condensing water when metal intervenes is usually from 13 to 15 degrees, whereas in the absence of such metal the difference is only about one-third of this. When there is plenty of water the difference in power required by a larger or smaller amount of water is so small as to be practically negligible. However, where water is scarce and expensive apparatus such as a cooling tower is put in to economize on the condensing water the difference is easily felt as the water has to be elevated to the top of the tower.

Suppose we consider a numerical example. The condenser creates a vacuum of 27 inches which gives a temperature of the steam 114 degrees and the total heat of the steam 1,116 B.t.u. If the difference between the exhaust steam and the condensing water is 14 degrees the discharge temperature will be 114—14 equal 100 degrees. Now if the condensing water has an initial temperature of 85 degrees, each pound will receive 100—85 equal 15 B.t.u. in passing through the condenser and the amount required to condense one pound of steam will be (1116—100) div. by 15

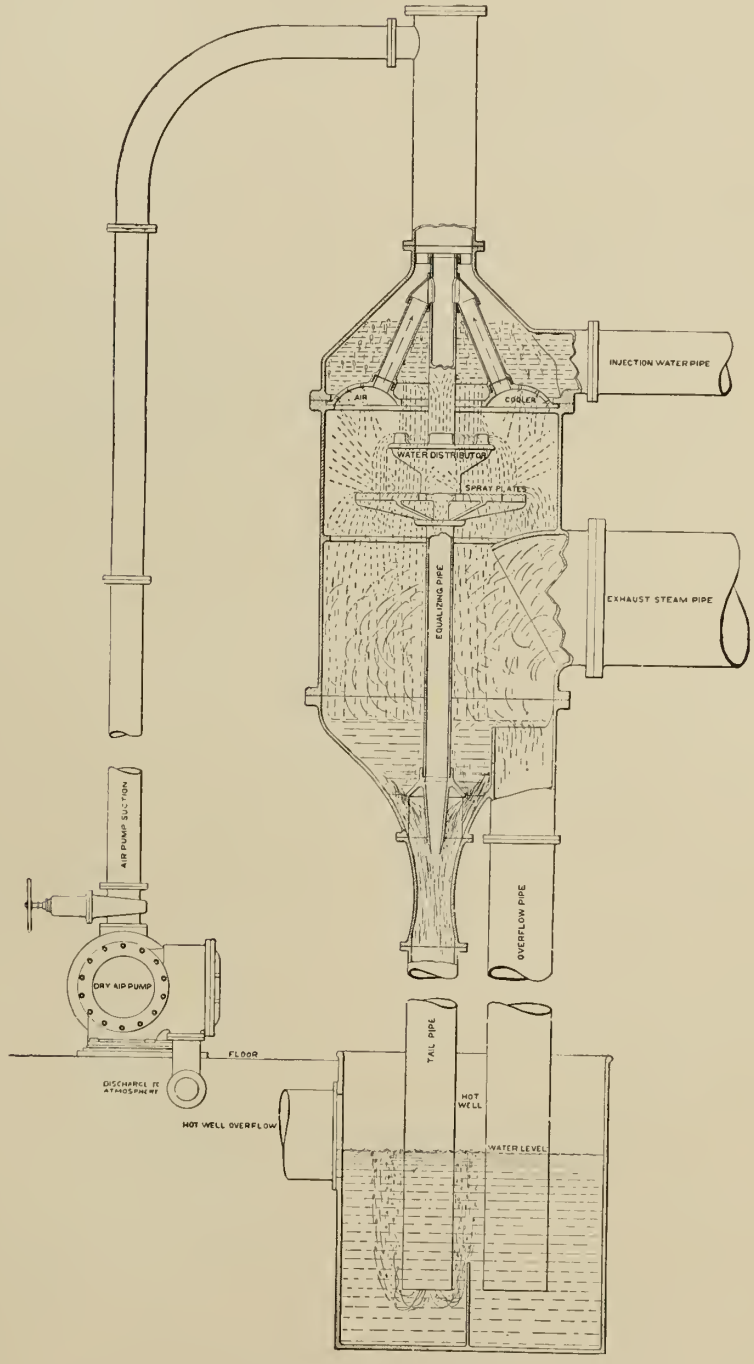



Fig. 6.—Tomlinson Type B Condenser.

equal 67.73 pounds. In the case where there is no metallic intervention and the difference is only 5 degrees the amount of cooling water required to condense one pound of steam will be (116—109) div. by 24 equal 41.95 pounds.

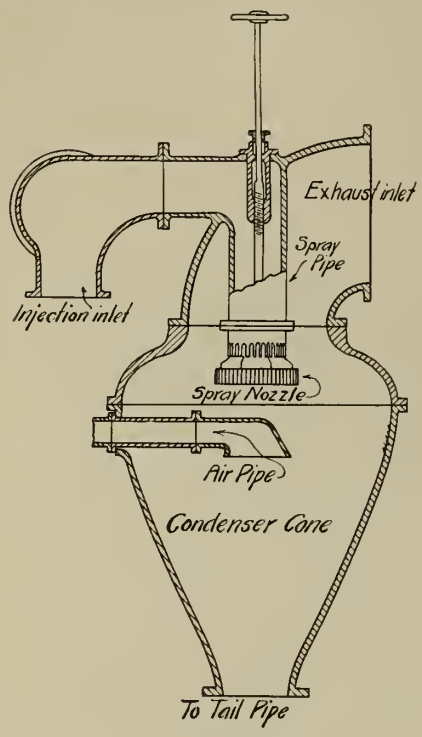



Fig. 7.—Section of Worthington Central Condenser.

Hence the amount required is 63 p.c. more in the case of the surface condenser. This represents also the difference in the power of the air-pumps required, the increased capacity of the condenser cooling tower, pipes, etc., all of which means the same ratio of increase in capital charge.

When the amount of circulating water available is small, the evaporative type of condenser is to be considered as the amount of water required to condense one pound of steam is within the limit of from two to ten pounds. The disadvantage of this type lies in the fact that it is of necessity some distance from the engine, being outside of the engine room, and trouble is liable to occur through leakage in the long length of pipes necessary, preventing the use of a high vacuum.

Although the first cost is small for small powers and vacua not exceeding 26 inches, a parallel flow jet condenser with wet air pump is an inefficient type, for the reason that the steam comes at once into contact with the coldest water with the result that very little rise in temperature takes place on the way through the condenser.

The difference in the temperatures of the condensing water and the exhaust steam may be as low as 3.5 degrees in a low-level counter-current jet condenser. There is a possibility of this flooding the condenser and exhaust pipe, but this is only very remote and the headway made in the manufacture of automatically regulated valves for the injection pipe and emergency vacuum breaking valve, make this danger even more remote.

A necessary adjunct to a condenser outfit is an atmospheric exhaust valve which lessens the danger of a broken condenser shell or low pressure cylinder should an accident to the condenser occur. It should be absolutely air tight and so constructed that there will be no possibility of its failing to open when required and there should be no means employed, other than atmospheric pressure to hold the valve on its seat.

## ELECTRICITY FROM SUN'S RAYS.

It is the claim of a Boston inventor that he successfully has solved the problem of storing the sun's rays and converting them into electrical energy. George S. Cove is the inventor, and he demonstrates the success of his idea by lighting his workshop in Somerville, a Boston suburb, with electricity generated from an apparatus on the roof. No electric wires of any sort enter his buildings from outside lighting sources, yet incandescent globes twinkle day and night, and electricians from the Boston Institute of Technology speak enthusiastically about the scheme. Cove has demonstrated that his device will store up sufficient electricity for an entire house. He says his machines, which can be built for $100 each, when incased in glass, will last for ten years without repair. The machine generates in two days of sunshine enough electricity to last six days.

Cove's invention consists of a framework to be placed in an opening where it will receive the direct rays of the sun. Short plugs of metal composition are set into this frame. The framework is of thin steel divided into squares, each one foot square, containing sixty-one plugs. These plugs project from cement, in which they are set, and come into contact with a thick glass which the sun strikes. Filled in around these plugs is a body of heat-absorbing material. The plugs are about an inch apart and are connected in series by a strip of metal. The difference of temperature of the two ends of the metal plugs, one being in the sun, the other in the open with a circulation of air around it, generates the current of electricity. If the sun goes under a cloud and the voltage drops below that of the storage batteries, an automatic cut-out breaks the circuit between the generator and the batteries. The device is thus entirely automatic. Cove is a practical inventor, who recently formulated a plan for harnessing the tides in the Bay of Fundy.

## EUROPE'S WATER POWER.

Guesses at the water power of different countries vary greatly and all may be wide of the mark. These are recent estimates of Otto Mayr, a German engineer: Norway, 7,525,000 available of which only 301,000 horse power is utilized; Sweden, 6,750,000 available, 200,000 used; Italy 5,500,000 available, 464,000 used; France, 5,524,000 available, 1,190,000 used; Austria, 5,125,000 available, 450,000 used; Germany, 1,677,600 available, 503,300 used; Switzerland, 1,500,000 available, 380,000 used, and Hungary, 550,000 available, 65,000 used. This is a total of 31,151,600 horse power for the continent of Europe, of which only 3,553,300, or less than 10.5 per cent., is utilized. The figures seem not wholly up to date, as Italy has been reported to have used 830,000 horse power, or 15.3 per cent.—all but 90,000 for electric energy.

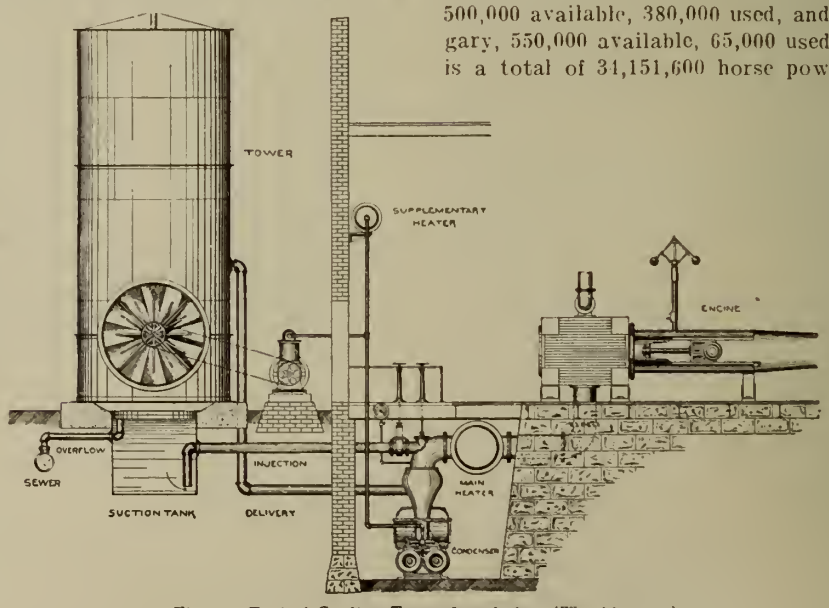



Fig. 8.—Typical Cooling Tower Instalation (Worthington.)

# Practical Information About Automatic Injectors

**The Injector should be given Great Care by the Engineer—Rules for the Care of Injectors—Its Construction and Operation, etc.**

This article is confined to the Automatic Injector, for the reason that it is more generally used at the present time than any other type. The "other type" is known as the "Positive" Injector, now almost obsolete, except for locomotive use, where generally very high pressures are carried. The range of the Automatic Injector, being from about 20 lbs. to 175 lbs. pressure, covers the pressures carried on at least 90 per cent. of all stationary boilers, and being much simpler in construction, has become more popular. Few engineers realize the delicate mechanism of an injector, and as a consequence do not give it the attention they do other boiler appliances needing really less care, but when it is taken into consideration that the variation of a thousandth part of an inch in a drill or reamer used in its manufacture will change its working qualities, some idea may be formed of its delicacy of construction.

In many localities the water used contains much solid matter, such as lime, magnesia, etc., and on account of the heat of the water passing through the Injector, this is precipitated and adheres to the tubes, contracting the passageways, gradually but surely, until very suddenly the engineer finds, to his consternation, that his Injector ceases to operate. Where such conditions exist, the entire Injector should be allowed to stand over night in a solution of one part muriatic acid to ten parts of water, which will dissolve the sediment, which will be blown out when steam is turned on. This should be done every week or two weeks, according to conditions.

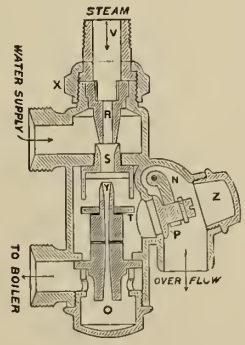
In purchasing an Injector, it should be borne in mind that capacities as shown by the different price lists are generally based on a lift of about 3 feet and pressures ranging from about 60 lbs. to 90 lbs., and that any condition other than stated on such lists changes the rated capacity; therefore with greater pressure or lift, allowance should be made. It is always advisable to have an Injector that will exceed your requirements as to a water supply for boiler, for by throttling the valve in the water-supply pipe the quantity of water can always be graded down to the amount required, and in doing this you increase the temperature of the delivered water to the boiler, which is a saving of fuel.

### Construction.

Referring to the sectional view of an Automatic Injector, Fig. 1, it will be noted that the entire working parts consist of three jets: (R) steam jet, (S) suction or lifting jet, (Y) combining and delivery jet. For the purpose of examination it is only necessary to remove the plug O, when the jet Y will come out with the plug. The jet

Automatic Injector.

R can also be removed by uncoupling the Injector from the piping by means of nut X. The jet "S" is screwed into the body of the Injector and removed by a slotted piece of ordinary steam piping. It will be seen from the above that these jets being interchangeable, it is only necessary for the engineer to send to his dealer for the parts, and he can make his own repairs. The overflow valve (P) is a very important part of the Injector, as it must be absolutely tight, but it can always be ground to a seat, in case it leaks, with a




Section of Injector.

screwdriver by simply removing the cap (Z). This Injector in its entirety, including couplings and body, has eighteen pieces.

### Operation of Injector.

The operation of this Injector is as follows: Steam is admitted to the Injector by means of a valve in a pipe attached to the "tail pipe" V through jet R, and passes with great velocity through jet S and out overflow P to the atmosphere. The water-supply pipe is attached to the Injector at the connection marked "water supply," the same having a valve close to the Injector, this pipe, of course, leading to a well or some other source of supply. The velocity of the steam passing into jet S creates a vacuum equal to 20 to 23 inches in the chamber where jets R and S meet. This entrains the air from the water-supply pipe, and atmospheric pressure forces the water naturally to this chamber, when it mixes with the steam and is forced with the steam out of the overflow. If the proportions of water and steam are correct, the velocity of the steam is imparted to the water and enters the jet Y, which converges to a very narrow space at the centre of this jet. From centre out it diverges, and it is owing to these peculiar tapers and parallels that sufficient energy is given to the water to overcome not only the boiler pressure, from whence the source of supply is taken, but all friction of pipes, elbows, etc., between the Injector and the boiler.

The water as it passes through this jet draws in the air from the chamber in which it is located, creating so strong a vacuum at the mouth of the jet Y, that the automatic valve T flies upward to its seat, and shuts off the communication with the overflow. With this communication shut off, the current must go through the jet Y to the boiler, and in its rapid passage through jet Y so strong a vacuum is formed that the overflow is forced to its seat by atmospheric pressure, when the injector is working; the valve in the water-supply pipe is for regulating the proper amount of water to the amount of steam. It may be said incidentally that under 70 lbs. pressure this regulation is necessary on a short lift, but above that it is only necessary to open and close the steam valve in starting and stopping the Injector, and all the operation of valves and vacuum, as above described, is almost instantaneous, and where the regulation is right the Injector will start without wasting a tablespoonful of water. It may be of some interest to state that taking steam from one boiler at 70 lbs., water can be forced into another boiler carrying 100 lbs., so great is the velocity and surplus energy of the water as it passes through these peculiar tapered jets.

In conclusion, it is advisable for engineers to give more attention to the Injector. Do not abuse or neglect it. It is a very important adjunct to a boiler, and will be of great service. Abuse or neglect it, and the engineer will certainly have cause to regret it.

# Setting Valves on the Ideal High Speed Steam Engine*

## Instructions for Setting, Adjusting and Operating Valve Motion, Governor, etc., of Ideal Engine, Manufactured by Goldie & McCulloch, Galt.

The first thing in connection with setting valves on the Ideal Engine is the Ideal cylinder relief valve.

The relief valves attached to cylinder

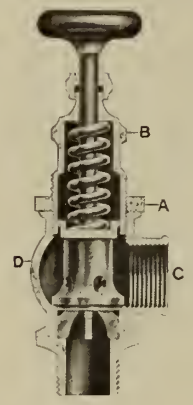



Fig.1.

are intended to prevent damage to engine if water enters the cylinder. Never run the engine without them attached. They will prevent breakage if the amount of water is not too large to pass through the valves and pipes.

### Directions for Re-setting Cylinder Relief Valves When Necessary.

When the steam in the boiler is at its highest pressure intended to be carried, open the throttle and turn the steam into the cylinder, then loosen the lock nut A shown in Fig. 1. If the valve is set too high, unscrew the case B until the spring is relieved so that the steam passes from the outlet C. If the valve should be set too low, tighten the case B until the steam stops coming from the outlet C. Next tighten the lock nut A solid against the top of the body D, which will complete the setting of the valve. **Be careful** that you do not screw the case B too far into the body D, or it will close the spring. One-sixteenth of a turn after the steam stops coming out of the outlet will be enough.

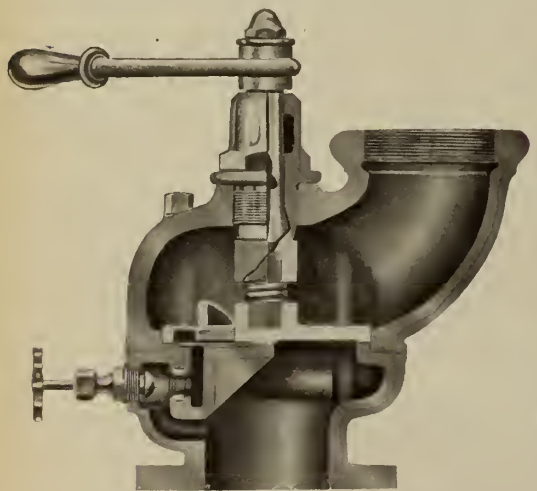


Fig. 3.—Ideal Throttle Valve.

### Before Starting Engine.

Before starting the engine pour about a pailful of water into the chamber at the back end of the frame, and then fill it up with oil till the oil just flows over into the chamber under the crank. Then fill this chamber till the oil stands one inch above the bottom of the disks, or up to the mark on the gauge. Fill the cylinder lubricator and start it to feeding. Fill oil pump and pour engine oil into the pockets on the main bearings. Fill eccentric oiler, and start it feeding. Put a little oil on crosshead through the hole in the top of frame. Open cylinder cocks and throttle valve **sufficient to warm cylinder and valve.** After the steam chest and cylinder are warm, turn the engine over by hand to see that all is free and ready to start.

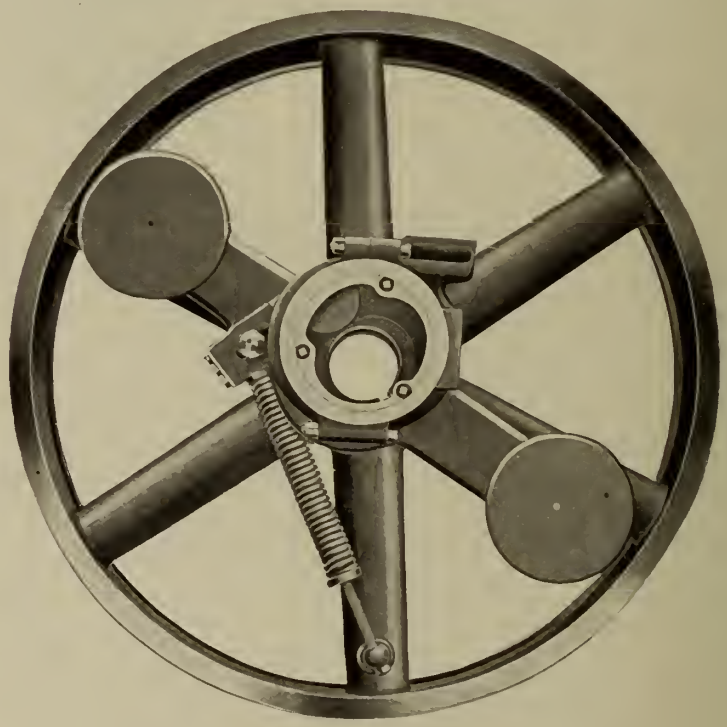


Fig. 2. Centre Crank Ideal Governor.

### Directions for Operating the Ideal Throttle.

Before turning on steam from boiler, be sure that the lever moves freely. If it refuses to move, or does so very hard, it is because the self-packing stem is gummed or stuck fast in its seat. Pour in a little oil at top of stuffing box where indicated, and tap lightly on top of stem with the hand or a block of wood. This will loosen the stem so it can be turned around freely.

**Always be sure that there is oil running from pipes into main bearing.** This oil passes from the main bearing through the crank pin, and is distributed over crosshead pin and slides.

Supply a little fresh oil to the basin each day, if the oil from the eccentric does not keep up the supply. **If the oil in the engine bed becomes thick, gritty, or dirty, so as not to flow freely through oil passages, draw it off and replace with fresh oil.** Filter the old oil, and use it over continuously. Use a pure mineral oil, without any animal oil mixed with it, that will not thicken by the churning it receives, and by the water leaking from the stuffing box of the piston rod.

If piston rod stuffing box leaks, the water will settle to the bottom of water chamber and run out of the automatic stop-cock.

Use only good cylinder oil, of not less than 600 deg. fire test for lubricating the valve and cylinder. Feed sufficient oil to cylinder so piston and valve will run noiselessly. Always warm the cylinder oil, and fill lubricator **full**

* Fourth of a series of articles on the setting of valves on the various Canadian made engines. The first article appeared in the May issue, the second in June, the third in July.

or it will not feed. If it fails to feed, use the oil pump or stop engine.

Serious damage and cutting of the cylinder and valve will result from allowing the lubricator to cease feeding even for a few minutes. If your engine is a new one from the shops, and, indeed, always, feed plenty of oil through the lubricator and oil pump for the first few weeks after starting. If your boiler is priming or foaming, use double the quantity of oil to protect the piston and cylinder from cutting.

**Adjusting the Rites Inertia Governor.**

Fill the cups on governor bearings with grease, and give the cap one-quarter turn every day. Whenever necessary the governor should be taken apart and bearings cleaned with coal oil.

The main thing about a governor of this type, (Fig. 2) is to see that the bearing is properly lubricated and is kept in good condition. If the governor bar does not swing freely in its bearing, the governor is liable to operate badly and will race.

In case of racing or irregular movement of the governor, first examine the bearing to see that it is not cutting and that it is free from gum and well lubricated. The bushing may be entirely withdrawn for cleaning.

The speed may be increased or decreased ten or fifteen revolutions above or below the normal speed marked on name plate by changing the tension of the spring. To increase this speed, tighten the spring; to decrease the speed loosen the spring.

The spring is attached to the governor bar by means of a sliding block. The governor is made more sensitive—that is, so it will regulate closer—by moving the sliding block in toward the centre of the bar; and the governor is made less sensitive by moving the sliding block out from the bar. If the sliding block is moved to change the sensitiveness of the governor it will be necessary to make a slight change in the tension of the spring to bring the engine to the same speed as before.

The speed of the engine, and also the regulation of the engine, is changed to a great extent by changing the weights on the inertia bar; but it is hardly advisable for any one who is not expert in adjusting this type of governor to attempt to make changes in the weights. In general, removing weight from the free end of the bar makes the governor less sensitive and less liable to "race," but not so close in regulation; and decreases the speed. Adding weight to the free end of the bar makes the governor more sensitive, more liable to "race," but closer in regulation; and increases the speed. Changing the weights in the end of the bar to which the spring is attached has, in general, the opposite effects to those caused by changing the weights in the free end of the bar.

Changing the weights in the bar is not advisable without first communicating with the makers for instructions.

**To Set the Valve.**

Should you wish to ascertain if the steam valve is properly set, proceed as follows: Take off the cover on outer end of steam chest, so you can have access to end of valve. Take off rubber stop to governor, so governor arm can come against the shaft. Turn the engine over until the valve has traveled as far as it will go towards end of steam chest. Then measure from the end of steam chest to the end of valve, and this distance should be represented by the figures in inches and fractions stamped on the end of steam chest. If measurements do not agree, set valve by screwing the valve stem at the ball joint.

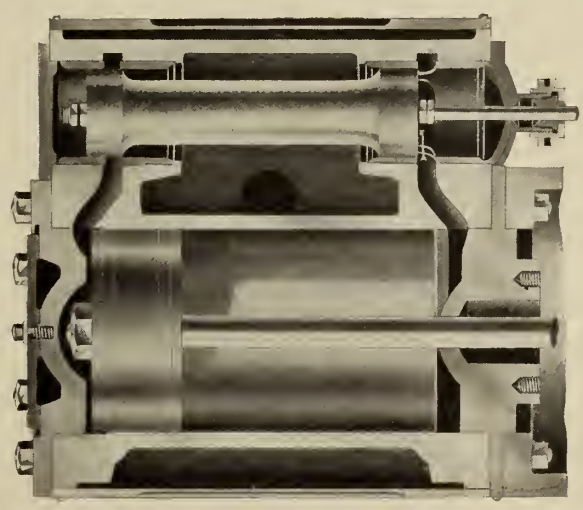


Fig. 4.—Sectional View Ideal Cylinder.

**Packing.**

Square packing, Daniel's, or similar, is the best kind for piston rod and valve stem. Don't screw the glands up tight; allow them to leak a little. The valve stem has only exhaust steam; don't pack it tight. Screw it up by hand only. Screwing the piston rod gland up tight may cause the piston to thump or pound the cylinder and heat and cut the piston rod.

**Eccentric.**

Take up lost motion by reducing the brass liners between the lugs on eccentric strap, and unscrew and disconnect the ball joint on the eccentric rod to see that the eccentric strap will turn freely on the eccentric. If a close fit, it will heat, cut, seize and break the eccentric rod or valve stem. Allow the eccentric strap to run loose; no harm if it knocks a little. It will not wear out or round on account of running loose; it is dangerous to run with the strap snug.

If either of the stem packings should commence to leak, it can be ground as easily and in the same way as a common stop-cock.

It is better to always start the engine with the by-pass, which, while plenty large for starting, is small enough so that it will not allow large quantities of water to enter the cylinder, from where it may have lodged in the steam pipe.

**To Start Engine With the Ideal Throttle.**

Partially open by-pass valve on throttle to drain steam pipe of water through drip connection below steam chest, and turn engine over by hand to warm valve and cylinder before starting.

To start engine, open by-pass valve to bring engine up to speed, **then slowly open throttle valve with the lever,** then close by-pass valve. Under no circumstances (except engine starts under full load) should engine be started with the lever, which **open slowly.**

---

B. J. Harpell has opened an office at 24 Aikins Block, Winnipeg. He is sales agent for Brodesser Elevator Mfg. Co., Ideal Motors and Generators, Buffalo Forge Fans, Pumps, etc. Mr. Harpell has also taken the western agency of the Machan & Mayer Electrical Mfg. Co., Philadelphia, who make a great many lines of electrical specialties.

Smith, Kerry & Chace, engineers, head office, Toronto; have just opened a branch at 71 Fairfield Bldg., Vancouver, B.C., where they will carry on British Columbia and Pacific Coast work. H. J. Haffner, McGill, 1904, who is in charge, is experienced in railway, municipal and irrigation engineering. It is proposed to do general business, including, in particular, water-power electrical development. Considerable irrigation and hydro-electric work will be handled.

# Setting and Operating the Steam Pump

A Paper Read Before the Elizabeth Mining School, Elizabeth, Pa., by William Joll, giving Some Important Information in regard to Pumps.

It should be the first care in installing the pump to provide for a full and constant supply of liquid to be pumped. In order to accomplish this, observe the following rules: The suction pipe should under no circumstances be of smaller size than that in the casting. When necessary to employ long lines larger sizes should be used, as the frictional resistance, due to the unusual length, will partly counterbalance the head, due to vacuum, and prevent an inadequate supply to the pump. Use as few T's and L's as possible. All valves employed should be of the gate pattern. So that the free way for the water may equal that of the pipe.

In laying a suction line, a uniform grade should be maintained in order to avoid air pockets. The suction should have a drop of not less than six inches in each 100 feet towards the supply. Extreme care should be taken to make the suction line and connections absolutely tight. When suction exceeds 15 feet, or the suction line is over 100 feet long, a foot valve should be used as it keeps the pipe and pump chambers constantly filled with water, thus avoiding the necessity of priming the pump before starting. It should be remembered that a very small leak will supply the pump with that quantity of air that little or no water could be obtained. It is desirable, therefore, that the suction line be tested under water pressure of from 25 to 50 pounds per square inch, in order that any leaks may be detected.

### Use Foot-Valve.

A foot valve can be employed to advantage if its location is such that it can be drained in cold weather to prevent it freezing. The valve will insure quick starting of the pump, by maintaining the suction line free from air and full of water. A strainer is desirable and is absolutely essential if the supply is taken from a point that may permit the entrance of foreign matter that will have a tendency to clog the water passage and the valves of the pump. The area of the openings of the strainer should be four times larger than the area of the suction pipe and they should be frequently inspected.

Priming pipes are desirable when connected to the discharge above the pump, so that the water boxes can be filled with water and started quickly. This is desirable and a necessity for a fire pump. When hot water is to be pumped, the difficulty of lifting by suction increases with the rise in temperature. It should, therefore, be arranged to flow into the pump, if so hot as to vaporize when the pressure of the atmosphere is removed. Thick liquids should also flow to the pump by gravitation. The steam and exhaust pipes should be as direct and as free from L's as possiqle. Both pipes should be thoroughly cleaned before starting the pump, so that metal chips from cutting pipe may not be carried into the steam chest and score the valves and seats.

Proper allowance should be made for the expansion of the steam pipes in connecting same up. A drain pipe or bleeder should be provided for live steam pipes, connection to be made directly above the throttle valve and with the drain so that the water of condensation will not have to pass through the pump. Oil cocks and drains provided for the water and steam ends should be opened after the pump ceases operation, so that the water may be thoroughly drained, thereby avoiding any possibility of freezing. If it is desirable to connect the steam and water cylinder drips to the same pipe, a check valve must be placed, closing towards the water cylinder, to keep it free from steam. All pipes leading to and from the pump should be properly supported, to avoid undue strain on flanges of the pump.

In starting a pump under heavy pressure it may fail to perform because of full pressure resting on discharge valves. You will discover that the air in pump cylinders is compressed and prevents water from entering. It is therefore advisable to start the pump without any pressure and run until all the air is expelled. This can be accomplished by suitable connection in pipes and waste pipe. In starting a new pump if it does not operate with a smooth and uniform motion, usually the first impression is that the steam valves are not set properly. These valves should be the last thing to be disturbed. Make sure that the suction and discharge water valves and everything connected with the water end is all right before investigating the steam end.

### Position of Valves.

There is only one proper position for the steam valves on a duplex pump, and this position is given them at the factory and to make them different would be wrong. If, on starting a pump, it is found that one or perhaps both pistons do not make full strokes, the cause can usually be located in the stuffing boxes. They are probably packed too tight. In properly packed stuffing boxes it is only necessary to draw lightly on the glands to prevent leakage, thereby not only saving friction but having a much smoother working pump. When water plungers are packed with fibrous packing, the trouble sometimes arises from the swelling of packing, causing the pump to operate stiffly, and making uneven strokes. This is especially the case when pumping hot liquids, and sometimes it is necessary to take the packing out and thin it down. In providing a piston with a new packing, it is well to soak the packing over night before putting it in.

In feeding a boiler or battery of boilers, the discharge pipe should be provided with a relief valve, so that if the pipe is throttled in any way, the pump may be relieved; otherwise excessive pressure will quickly accumulate. Such relief is absolutely necessary for power pump. The excess of water may be by-passed to suction or delivered to waste pipe. In feeding a boiler or battery of boilers with an ordinary duplex steam pump, which is the crudest and oldest type of slide valve engine, taking steam under full head throughout the entire stroke and exhausting under full pressure, the steam actually consumed to operate the steam boiler feed pump, even when the pump is new and in perfect order, is often as much as is required to operate the high grade engine that is developing the power; and if the pump is in poor order, as is usually the case, the pump takes more steam than the engine. This great steam consumption can be saved by using a power pump, belt driven from the line of shafting or where electricity is available by direct connection to a motor. On plants of any size the saving will pay for the cost of installation in a year.

### Situation of Pumps.

All pumps should be placed as near the source of supply as possible. The vertical distance from the surface of supply to suction of the pump should not exceed 25 feet. The height of the column of water which will balance the pressure of the atmosphere is 34 feet; that is a column whose weight is about 15 pounds per square inch. In practice, however, the supply can never be drawn from a depth greater than 25 feet. Water is raised by pressure of air on the water outside the pump. The piston of the pump exhausts the air and the unbalanced weight of water causes it to rise within the pump or pipes supplying the pump.

In setting a hot water pump, the pump should be lower than the source of supply.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

## EXPERIENCE ON THE ROAD.

By R. F. Howard.

### Ease With Which a Turbo-Generator was Paralleled.

Circumstances made it necessary for a certain hydro-electric power company to get a 1,500 kilowatt steam turbine unit into service sooner than had been originally contemplated. The turbine and generator were already installed, but the switchboard had not yet been received. A temporary switchboard was erected on which were mounted a polyphase wattmeter, two generator ammeters and pilot lamps. The generator leads were brought to the switchboard and from it the lines were extended to the main operating station about half a mile away. Here the lines were connected to an oil switch which was used to connect the turbo-generator in parallel with the rest of the system. A synchroscope was installed at the main station and the steam station was advised by telephone as to the relative speeds and phase relations of the two plants. After the connections were completed the stations were operated in parallel daily during the peak hours for over a month. But for the fact that the meters on the temporary board showed signs of life no one in the steam station could tell when the connection between the stations was made, so smoothly was the system paralleled. Only a trifling adjustment of the steam turbine governor was necessary on the first occasion, and practically no adjusting had to be done on subsequent occasions.

No voltmeters were used on the exciter or alternator circuits, indications of the potential being obtained from pilot lamps. Not the slightest mishap occurred while the temporary outfit guided the men in the operation of the plant. This method of paralleling might seem at first thought to be hazardous, but no great trouble should be experienced if the proper indicating devices are used and care taken by the operator in connecting the machines together.

### Paralleling Generators Out of Phase.

A large manufacturing company operated two water-power plants in multiple, one situated in their mill and the other about ten miles away. The generator in the mill was a 500 k.w., three-phase, 2,500 volt machine and was connected in parallel with the rest of the system twice every twelve hours.

The writer was instaling a steam turbine set which was to operate in multiple with the other systems, and, as the results obtained when paralleling the turbo-generator were so satisfactory, attention was called to the unit in the mill, where heavy cross-currents were experienced each time it was paralleled with the rest of the system. In looking over the connections it was found that the synchronizer was connected to phase 1 and 3 on the generator side of the switches and to phase 1 and 2 on the other side, so that each time the attempt was made to synchronize the generator phase 1-3 of the generator was brought into step with phase 1-2 of the line, whereas corresponding phases of the generator and line were connected when the switches were closed, thus causing the heavy cross-currents. The synchronizing connections were changed and no further trouble was experienced in paralleling. The units had been paralleled in this way for nearly three years.

### Phantom Grounds.

A municipality installed a plant for street and house lighting, all the feeders being lead sheathed and underground. On starting up the plant the ground detector indicated grounds on the system. Much time and money was spent in trying to locate the faults. The ground detector consisted of a voltmeter of the switchboard type operated from the low-tension side of a 15 watt potential transformer, 2,000 to 100 volts, and so arranged that one terminal of the transformer could be connected to each phase of the generator and the other terminal connected to ground. When used in this way the voltmeter always gave some indication.

However, no grounds really existed on the system, the indications being due to condenser effect, for with the ground detector connections as stated, there was sufficient charging current in the transformer winding and voltmeter to make the instrument read and give the operator a false indication.

Another case similar to the above was investigated recently where an alternator was reported "grounded." The alternator was connected to a bank of transformers and it was known that a ground existed on the system, which was afterwards found in one of the transformers. The observer had taken readings on a voltmeter from the three terminals of the machine to ground, and concluded that this was sufficient proof of the generator being grounded. The reason that the voltmeter read in this way was that the armature winding of the alternator had considerable capacity to ground, and a circuit was made through the voltmeter when connected as described.

Very different results were obtained by using transformers of various capacities to operate the voltmeter; the highest reading was obtained when using a voltmeter transformer, but with a five k.w. transformer there was no deflection. The indications on the voltmeter would depend upon the impressed voltage on the high-tension side of the transformer. The different voltmeter readings with the different transformers are accounted for by the fact that the magnetizing and iron loss currents varied considerably in the different sizes used. The smaller the transformer the higher the voltmeter reading. The five k.w. transformer required a magnetizing current that would cause most of the drop to be across the condenser effect.

### Transformer Troubles.

A ground was observed on a high voltage system being fed by ten oil insulated, water-cooled transformers. Considerable time was spent in locating the trouble and it was finally traced to one of the transformers. Investigation showed the trouble to be due to water in the oil that seemed to concentrate itself at one spot on the insulation and iron. Condensation had taken place on the cooling coils just inside the case and where the lagging had been torn off. The drops of water fell into the oil and went to the bottom of the tank, causing the trouble. New lagging put on the coils effected a cure, the transformer continuing in operation without further difficulty.—Electric Journal.

---

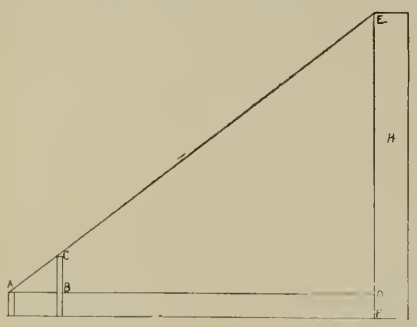
## JACK TELLS JIM HOW TO FIND THE HEIGHT OF A SMOKE-STACK.

By James E. Noble.

One day last week I called upon a brother engineer. He rooms with a private family, I mean in the same house you understand, and from his window can be seen several tall smoke stacks, which in spite of the smoke by-law, traveling grate bars, steam jets, hot air jets, and hot air stories, will

still persist in throwing out black smoke for more than the six minute limit, thus causing streaks of white to show in the poor engineer's thatch at night (when he gets the coal dust, oil and other foreign matter accumulated during the day, while he is earning the elusive dollar) washed, combed or coaxed out.

"See that tall stack, John," said I. "Sure Jim." "What is its height?" I enquired. "Search me," was the grammatical reply, "but if you want to find out and do not mind a little trouble, you can use a little scheme, invented over a hundred years ago, to get the approximate height." Said I,




How to Measure Height of Smokestack.

"Elucidate and never mind ancient dates." John pulled down his cuffs, cleared his throat, and as it was in a bar-less part of the city he started his private lecture in a dry voice. "Hem, likewise, ha! I believe you understand the doctrine of similar triangles." "Of coarse," said I, "almost every youngster at school does."

Well, here I make a little sketch, A represents yourself, B represents another stick. Excuse me Jim, that was a slip. I did not intend to insult—the stick. H is the stack. Now take a light rod or lath, just long enough to reach from the ground to your eye, place it so that your eye at A may see C, the top of the other pole or stick, and E the top of the stack, or other height, in a straight line. Then the triangles ABC and ADE being similar. AB : BC :: AD : DE and DE X FD equal FE, the height you want."

"There are three other ways of approximating heights of inaccessible objects by similar triangles just as simple as the foregoing, namely, by a geometrical square, by shadows, and by reflection in a basin of water, but I guess I had better ring off, for I know you of old, and I can imagine how the proof reader of MS. at the office will curr— I mean bless you when he gets this back number lecture. Well keep me out of it.

## FEED WATER REQUIRED BY SMALL ENGINES.

In the following table, column A represents the pressure of steam in the boiler as indicated by the steam gauge. Column B shows the number of pounds of water required per effective horse power per hour.

| A. | B. |
|---|---|
| 10 | 118 |
| 15 | 111 |
| 20 | 105 |
| 25 | 100 |
| 30 | 93 |
| 40 | 81 |
| 50 | 79 |
| 60 | 75 |
| 70 | 71 |
| 80 | 68 |
| 90 | 65 |
| 100 | 63 |
| 120 | 61 |
| 150 | 58 |

## TO STOP THE HAMMERING IN THE PUMP.

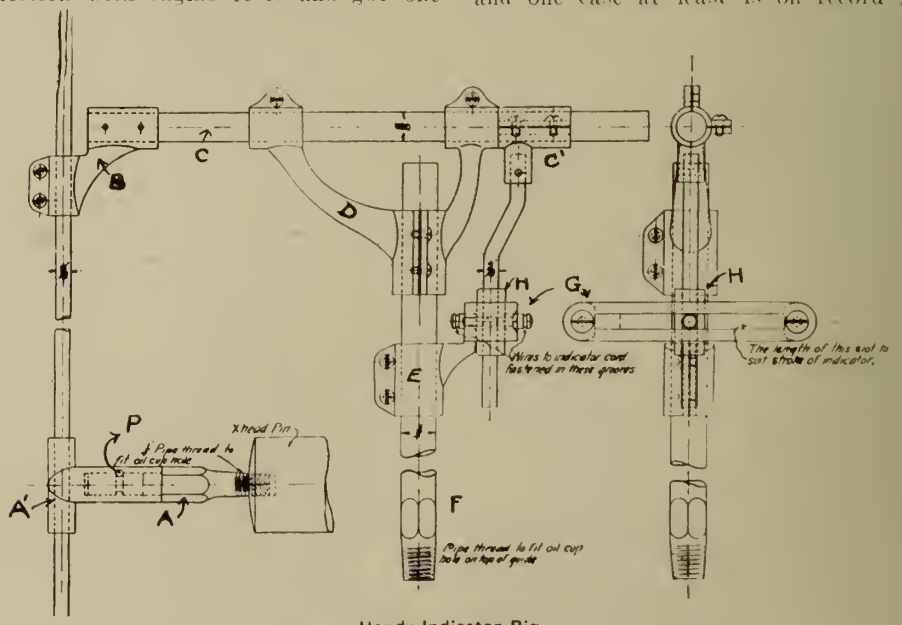
By Jas. Thomas.

Tap the pump end, cover with half inch pipe, on which place a vertical check valve that will open as the water enters, then a globe valve which must be just started and not full opened.

## A SIMPLE INDICATOR REDUCING RIG.

By F. Ceedie.

The accompaning illustration shows an indicator rig which was designed by Mr. G. Pickles, Brantford. He has had a lot of traveling around to do in connection with engine tests and got out this rig with the end in view of its occupying but little space when dissembled.




Handy Indicator Rig.

The castings are of brass while the rods are cold rolled steel. The large range of adjustment capable makes it very easy to line up.

The part marked A is screwed into the end of the crosshead pin. This part has a projection over which the part A' fits and is held against end movement by the pin P which engages the groove cut in the projection of A. A' is free to rotate about A and the 5-16 inch rod is loose to slide in A', but is fastened rigidly to B. B is riveted securely to the rod C', whith may be adjusted endwise. C', when in position, is rigidly secured to C and by virtue of the offset 5-16 inch rod the part H is made to slide in the slots in G. The wires to indicator cord are fastened to two projecting buttons on either side of H.

F is screwed into the top of the crosshead guide (usually in the hole tapped for the grease cup) and the part E is adjusted vertically to shorten or lengthen the travel of the indicator as desired.

## AVOIDANCE OF VIBRATION AND NOISE.

By J. A. S., Newcastle.

One of the chief troubles which occurs to harass the manager of an electricity supply station situated in a fairly high class neighborhood is the fact that the inhabitants of that area manifest reasonable or unreasonable prejudice to the existence of the station. Complaints are frequently made that doors and windows are rattled by the vibration proceeding from the central station, and one case at least is on record in which an important station has to pay annually to a business firm a considerable amount as compensation for vibration caused to warehouse property in the vicinity. Under these circumstances a few notes regarding the avoidance of noise and vibration on the exterior of

central electricity supply stations may be of interest.

One of the first points of eourse is the avoidanee of heavy unbalanced masses of metal in rotation or reciprocation. The turbine is coming more and more into use as opposed to the older type of steam engine and with the disappearance of heavy horizontal or vertical engines a large amount of the necessity for heavy foundations and rigid construction is disappearing.

Electrical engineers in charge of alternating current machinery are so inured to the constant hum of the alternators that they are apt to regard this noise as an ordinary event ; it is however somewhat distressing to people living in the vicinity, as the note there frequently is of a carrying nature and may cause serious inconvenience. This hum is principally due to the minute meehanical displacements of the iron core surrounding the stator or rotor windings of the alternator ; these displacements attaining greater amplitude when the currents become considerably out of phase with the impressed volts, owing to the fact that alternations of positive and negative power are being obtained in the machine. The installation therefore of a phase meter on the switchboard may do a considerable amount towards minimizing the hum of the generating machinery by keeping the switehboard attendant's attention constantly directed to the fact that he is losing power. A certain amount of induction is, of course, necessary in most alternating eurrent stations and sub-stations, but a good deal can be done by the proper regulation of excitation of alternating current dynamos and motors on a system, especially when it is used for power transmission purposes.

In some cases, however, internal noise in a station cannot entirely be overcome. When this is the case the next step is to determine how the noisy part may be isolated from the rest of the building, or if this eannot be done, how the building as a whole, may be isolated from the rest of the world as regards vibration and noise. A very common cause of trouble is the engine, and here it has sometimes been the practice to isolate the engine bed from all the surrounding structure and to seeure it in such a way that the vibrations are not transmitted to the rest of the building ; in other words sdfficient inertia is provided in the mass of the foundation itself to form stability against the recurrent shock of moving parts, while in order to give mechanical support a bedding of sand is placed all round and under the actual eoncrete base and kept in position as far as possible by sealing with cement. This ean only be regarded as a tentative method and a far better arrangement is to use some material whose particles are bound togetner and yet are not too rigid, such as felt, as a base on which to rest the foundation. It should be made waterproof either by means of some chemical preparation or by soaking in oil. A sheet of this felt should be placed on a prepared concrete slab forming the commencement of the foundation, upon this is placed the main body of the foundation carrying machinery which is liable to jar, and this foundation is separated from the rest of the building by means of an air space, thus locating trouble to a small area. Another method is to place the bedplate of the machine on india-rubber stools. Articles of this nature, made for the purpose, are now upon the market.

Where it is impossible by means of the size of the plant or consideration of trouble in steam pipes breaking joints through shifting machinery or similar causes, it is advisable to eonsider the sheathing of the whole building or a certain part of it with some material such as the felt mentioned.

Another class of sound-deadening material which is much used in architectural work is Cabots quilt, which is really a felted preparation of ell-grass held in place between two layers of tough manilla paper by "quilting." It is an exceedingly soft elastic eushion and is impervious to vermin or insects because of the saline origin of the material. When made up into quiltings, it is exeeedingly useful for deadening sound when placed in conjunction with the walls.

The provision of double doors and double window casings has a considerable amount of influence in deadening sound in sub-stations adjacent to dwelling house property, provided that strict instructions are left with the attendants to keep these doors and windows closed. When this, however, is the case special ventilating arrangements are necessary in the building and whereever possible buildings intended for the reception of generating or transmission maehinery should be kept away from localities where complaint is likely to arise. The writer knows of one instance where the basement of a large block of office property was used as a sub-station and one of the machines was placed in elose contact with an iron girder which eommunicated with one of the principal uprights of the building. A musieal note that was almost inaudible in the sub-station itself was by means of this upright transmitted to a large number of offices throughout the building occasioning serious inconvenience, resulting in considerable expense being undertaken to shift the machine from its unfortunate position.

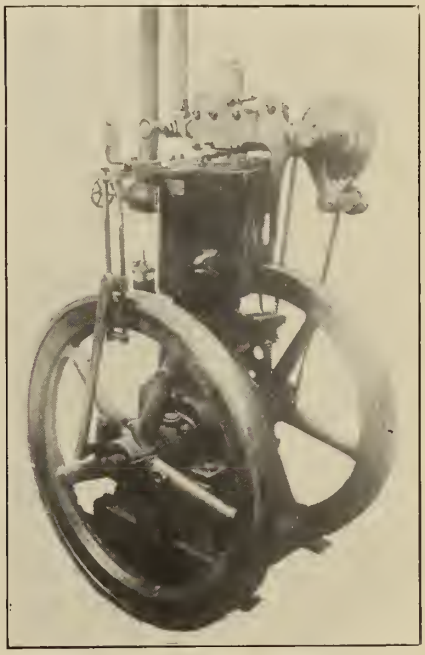
---

## UNIQUE ENGINE USING AIR AND STEAM.

By Frank C. Perkins.

A horizontal air steam engine constructed at the Iowa College of Engineering, Ames, Iowa, demonstrates the advantages of using both air and steam in a prime mover. A vertical gas engine was changed to an air and steam engine and locomotives have also been tested which have given most interesting results.

It is held that the theory, experiments and actual practice have demonstrated the fact that a mixture of vapor and



Vertical Gas Engine Changed to Air-Steam Engine.

neutral gas is a more efficient and a more economic working medium than steam alone or than gas alone. The most common vapor is steam, the most abundant gas is atmospheric air, but the gases of combustion obey the same laws. Hence a mixture of vapor and gas may be steam and air, or steam and gases from combustion.

One of the most striking examples of a mixture of vapor and gas, is the alcohol explosion engine. The alcohol is diluted with water, and when the compressed mixture of air and diluted alcohol vapor are exploded in the cylinder, the alcohol is burned to a neutral gas and the water is converted into steam (vapor). Clearly then the explosion engine, operating with diluted alcohol as its fuel, utilizes this mixture of vapor and gas as its working medium.

A number of experiments and tests

have been made with the alcohol explosion engine, and official government reports have been issued by Germany and by the United States showing substantially the following facts: That an explosion engine must be specially built with very high compression to use alcohol as its fuel and secure the best efficiency. In the best alcohol explosion engine, the efficiency varies when the percentage of water diluted is changed.

With 10 per cent. water and 90 per cent. alcohol, a high compression explosion engine gave 31 per cent. heat efficiency; but the same engine, operating with 17 per cent. water and 83 per cent. alcohol, gave 42 per cent. heat efficiency. It is perfectly obvious that the the efficiency depends very largely upon the proper degree of water dilution, or the proper ratio of vapor and of gas in the mixture.

It is held that the economy of a mixture of vapor and nentral gas is fully explained by the fault that, during expansion, there is a heavy transfer of heat from the steam to the gas (or air) in the mixture. The heat which is transferred is strictly the latent heat of the steam and the same latent heat which would otherwise go out at the exhaust of a steam engine.

This transfer of heat from the steam to the compressed air in the expanding mixture is demonstrated by the temperature curves obtained. One cubic foot of steam at 50 pounds pressure expanding to 10 cubic feet, drops from 280 degrees down to 165 degrees below zero. If the two were mixed at the same pressure and temperature, it must follow that the air could not grow so extremely cold, but must receive a large amount of heat from the steam.

It may be mentioned that the laws for steam alone are well known, also the laws for gas or air alone, but the only laws for a mixture of vapor and gas are the laws of Gay-Lusac, of Dalton, and all saturated mixtures or vapor and gas obey these two laws.

The first is that the pressure, and consequently, the quantity, of vapor which saturates a given space are the same for the same temperature whether this space contains a gas or is a vacuum and the second is that the pressure of a mixture of a gas and a vapor is equal to the sum of the pressure which each would possess if it occupied the same space alone.

E. J. Christie states that this is practically a new field of research, and the mixture of vapor and gas may be introduced into several new systems of motive power and there has already devised three separate and distinct systems to use the mixture.

The chief merit of the air-steam system is that it has the effect of giving a non-condensing engine all the advantages of a condensing engine without the necessity of a condenser or water for condensing purposes. When this mixture expands in the cylinder the air (gas) absorbs a very large percentage of the latent heat in the steam, whereas said holding up both temperatures and pressure of the air in the mixture, the performing more work by utilizing the latent heat in the steam, whereas, said latent heat has hitherto been wasted in the exhaust of the present steam engine.

It is claimed that the mixing of the compressed air in the cylinder with the inflowing steam from the boiler causes the steam in the mixture to become superheated, and the engine has this additional advantage of being supplied with superheated steam.

When air at 150 pounds is mixed with steam at 160 pounds, the mixture will be at the same temperature as befor for steam but the air and steam pressures will each be 75 pounds. The total heat of steam at 150 pounds being greater than that for 75 pounds allows intrinsic energy to be so changed that the steam will be superheated about 50 degrees.

The best possible ratio of air and of steam in the mixture is obtained, it is held, also perfect steam distribution; and the impossibility of negative work in the cylinder or a reverse loop in the indicator card, no matter how early the cut-off of the steam.

It is claimed also that practically all clearance losses are avoided because the clearance is filled with compressed air at practically the same pressure and temperature as the steam in the boiler.

---

## INCREASING THE EFFICIENCY OF POWER PLANTS.

By A. J. Desand.

The following is an account of the experiences of a young engineer friend of mine, and I hope that they may prove interesting reading and also help someone else who may be in a similar position in a small linghting plant. This young man, having been a year or so in a small lighting plant that was amply large for its work, and in fine condition, had studied long and faithfully in a good correspondence school and longed for an opportunity to put some of his knowledge to work at earning dividends. He, therefore, accepted a position as chief engineer, oiler, fireman, electrician and general repair man in a small lighting plant containing one 150 h.p. boiler, one 85 h.p., and one 35 h.p. engine, both engines being side crank, high-speed, one right and one left-hand, being connected by friction clutches to the two ends of main shaft, from which the 1,100-volt alternator and d.c. arc machines, were belted. This plant was in use from early evening until midnight.

Arriving on the scene of his future endeavors, he found everything half buried in grease and coal dust, and on starting up in the evening, the noise made by the bearings of the larger engine was somewhat startling, to say the least, and as it increased as the load came on, by the time the arc lights were on it was deafening. To add to the already large troubles, the fire went bad, clinkers sticking to the grates and causing them to get red hot, while steam gauge showed that pressure was steadily falling.

The details of the story are too painful to be given here, suffice it to say that he managed by heroic efforts to keep the lights dimly burning until peak load was past and at 12 o'clock midnight, shut down the plant, went home and went to bed, but not to sleep. No, that waking nightmare kept him tossing back and forth for several hours, but in the early morning he dropped peacefully to sleep, having thought out many little improvements that could be made without need of much new material or without interrupting the evening lighting service.

The large engine was first attended to as this was carrying all the load, the boiler being unable to supply the steam if both engines were running. It was badly out of alignment, owing to wearing down of main bearings. As time was limited, the shaft was wedged to place, burrs cut in babbit lining with a chisel, and babbit melted and poured around the shaft, oil holes and channels cut in bearing-cap and engine started up for evening load.

There was still noise enough to disturb the soundest sleeper that ever hugged a pillow, and the next day operations on this engine were began once more. The wrist-pin was found to be nearly ¼-in. out of round, and was soon turn up in lathe and fitted in its bearing, this making a great improvement, but there still remained a loud crash at the end of each outward stroke of piston. This was found to be due to piston striking the head and was soon cured by putting in liners between stub-end of connecting rod and the brasses.

The next thing to receive attention was the valve of large engine. This was leaking badly, being a flat slide valve with a pressure plate. As the cylinder could not be sent to shop, the valve and pressure plate were faced up in a shaper and then valve seat was scraped to fit by hand, using red lead to show high spots, removing these and fitting

again. Later this was also done to smaller engine.

There was such a decided improvement in the operation by this time, that the engineer was encouraged to try some more stunts. The next thing was the boiler, (which, as usual, had been left to the last), it was leaking at the rear tube sheet and it was also a continual battle to keep up steam. An expander

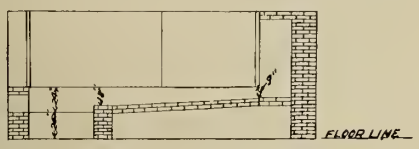



Fig. 1.—Old Arrangement

failed to tighten tubes, but a few hours' work with a hammer soon beaded them over so that they were all tight.

As draft was very poor for the height of stack, a search was made for the cause, and many leakes were found in the brickwork at rear arch and also in the connections to the steel stack. These were all closed, as well as could be done with brick and fireclay, but although the draft was much better, too much coal was being burned, and this was finally thought to be due to lack of sufficient space for combustion, as the space under boiler was as shown Fig. 1. Although this had been successful with wood, the setting was changed, as shown in Fig. 2. This reduced the amount of fuel and also increased capacity of boiler. The operation was much better and the engineer had time to look around and plan some more improvements, as the larger engine was heavily overloaded when carrying peak load alone. It was desired to use the smaller engine to help it out, but it was almost impossible to divide the load properly between them. so the arm of the shaft governor on small engine was pried in till the valve cut-off steam at about ⅜-stroke, and a block bolted behind it to hold it from springing back, while leaving it free to move in and cut off steam earlier if speed in-

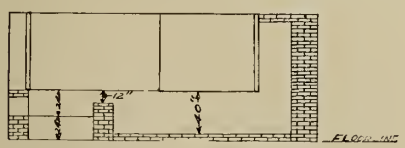


Fig. 2.—New Arrangement.

creased beyond normal. The governor spring of small engine was then adjusted til small engine tended to run slightly faster than large engine, and the operation was then as follows: The large engine would first be started when lights were first wanted in the evening and when load came on to a certain point, the small engine would be run up to speed on throttle, (synchronized in) by looking through spokes of flywheels and closing clutch at right moment, throttle would then be opened to full amount and small engine would take about 25 h.p. of the load. This relieved the big engine of that amount, thus operating both engines at most economical point of cut-off. As the load went off, the small engine throttle was closed and clutch thrown out, letting the large engine carry the load alone until midnight..

This plant also contained a T.H. arc machine that was running on about one-half its rated load. If any of the lamps went out, the regulator would draw the brushes up to such a point that the armature would be short-circuited, and it would soon heat to such a high temperature that it would have to be shut down to cool off. This could have been remedied by adding more lamps, reducing the speed or weakening the fields of the machine. It was decided to do the latter and as this was a series machine, this was done by making a low resistance shunt of fine iron wire wound on wooden mandrel and connected across the series field of the machine, a switch being placed in this circuit and opened when machine was first started, to enable it to pick up its load at once. (See Fig. 3.)

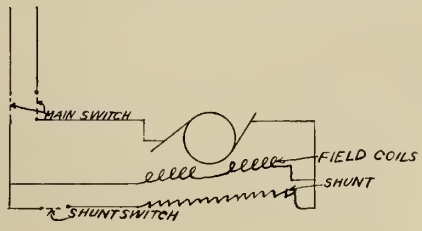



Fig. 3.

These several improvements had made such a change in the operation of the plant that the engineer now had a much more enjoyable position and the plant gave its customers greatly improved service. Its owners were able to make a larger profit out of it than before and very little capital had been expended, which is a very important item in a small plant of this class, where revenue from lighting is very limited.

## SOME USEFUL DEVICES.

By M. G. Smith.

Handy Wrench. Sometimes it is impossible to secure a wrench to fit some of the nuts occasionally found on machinery. The difficulty may be overcome by securing a piece of gas-pipe and hammering it to the shape of nut. By drawing in the other end of the same pipe a different size may easily be made. After both ends have been finished, the centre may be slightly flattened to make a good grip for the monkey wrench. It is surprising what the wrench will stand.

Cleaning Boiler Tubes. It is sometimes a tedious job to clean the scale off the tubes at the ends. Fig. 1 shows a device I am going to try. An iron rod is made with a T-handle shown at A. B is a round stem and C is a heavier and shorter T with sharp corners instead of round like the handle. By working this cleaner up and down and also by turning, it is claim-

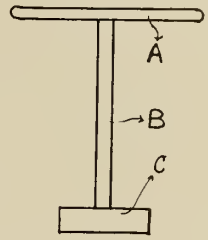



Fig. 1.—A Handy Device.

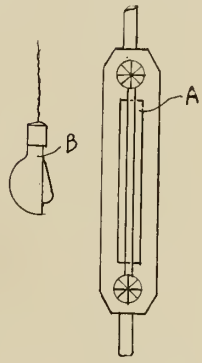



Fig. 2.—Water Glass.

ed to do very satisfactory work. C is made about 1 inch square and about 6 ins. long. It requires a little practice to acquire the right motion to use.

Easy-Reading Water Gauge. Place a strip of tin painted black with a white stripe, (or pure white will do) behind the glass and allow a semi-covered light to fall diagonally across the glass. In Fig. A is the tin and B the glass. In Fig. 2 A is the tin and B the the water visible at a considerable distance.

## TESTING THE EXPANSION CURVE.

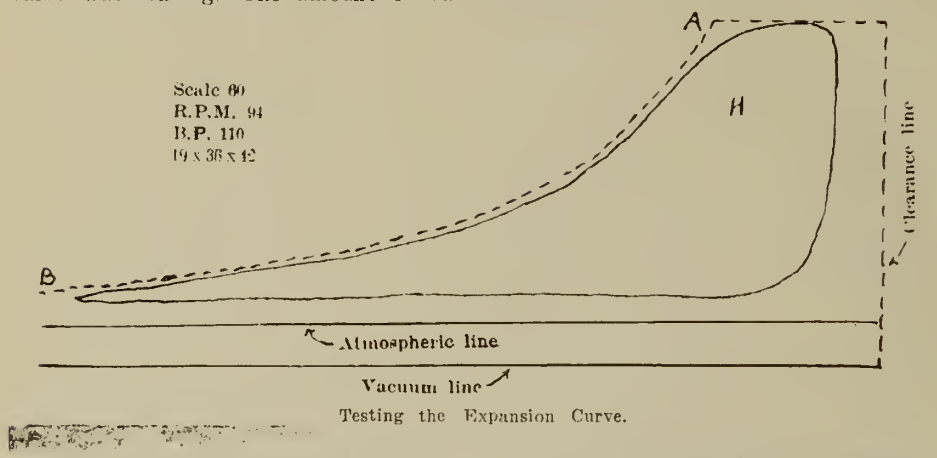
By J. E. B. Phelps.

In order to test the expansion curve of an indicator diagram it is customary to compare it with a curve representing Marriotte's law for the expansion of a perfect gas. In drawing this curve, it is necessary to take the clearance into account and also to find the point of cut-off the clearance must be included. This curve does not however truly portray the true expansion of the steam on account of the drop in temperature, but it is close enough for all practical purposes.

The result of such a test is shown in the accompanying diagram, which was taken from the head-end of the high pressure cylinder of a cross-compound, condensing engine, 19 x 36 x 42, scale 60. Boiler pressure 110lbs. Rev. 94 per min.

The point of cut-off A, was located by finding the number of expansion which in this case was 4.6 and dividing the diagram into this number of parts starting from the clearance line. The dotted line A-B shows the theoretical expansion curve and it will be seen that the expansion curve of the diagram coincides with it very well with the exception of near the point A or first part of the stroke, which I believe is caused hy condensation and the large clearance space, while the line on the later part of the stroke is held up to the theoretical line through re-evaporation.

I think the card shows that the valves are in good condition as far as leaks are concerned, as the expansion curve would rise above the theoretical line if the steam valve was leaking and drop away from it to quite an extent if the exhaust valve was leaking. The amount of variation in either case of course depending upon the extent of the leak.



Testing the Expansion Curve.

## SIMPLE TESTS FOR DETERMINATION OF FOREIGN MATTER IN WATER.

By John C. Tweedale

In performing the different tests described in this article, it will be necessary to observe strict cleanliness, otherwise the traces of the chemicals of one test are liable to creep into another test of a different nature, and thus render it valueless. They are simple, and inexpensive, some test tubes, a spirit lamp, a graduated measure, and the necessary chemicals as described in the tests, are all that is required. The chemicals are only nsed in small quantities, and they should be pure and up to the standard. A large number of tests are made when a thorough analysis is reqnired, but these are the ones that principally interest the ordinary engineer, and can be made with least trouble and expense. Analysts should be employed to make an exact analysis of important supplies.

### Organic Matter.

Asimple test for drinking water is made by taking a perfectly clean glass stoppered bottle, and putting in 5 ozs. of the water to be tested. Add 10 grains of pure granulated white sngar, cork cork tight and set it in a window exposed to the light, but not to the direct rays of temperature shrdlu cmfwy shrdlu cm of sun. Do not disturb the bottle, and keep the temperature as near 70 degrees F. as possible. If the water contains organic matter, within 48 hours an abundance of whitish specks will be seen floating about, and the more organic matter, the more specks. In a week or 10 days, if the water is very bad, the odor of rancid butter will develop.

### Hard Water.

For this test, a soap solution of about three part of water to one part of soap is necessary. The water shonld be soft and clear. To ascertain if the water is hard, or soft, pour about one inch of soap solution in a test tube, and add a few drops of the water to be tested. If the water is hard, the solution will turn milky or curdy.

### Acidity.

For this test, some blue, and red litmus paper is required, also phenophthalein. This chemical is a very delicate indicator, which turns the water (to be tested) a red color if alkali is present. Take a test tube and pour some of the water under test in the tube, next dip a piece of red litmus paper in the water, and if it does not turn blue, the water is not alkali. Then dip a piece of blue litmus paper in the water, and if it does not turn red, the water is not acid. Or a few drops of phenolophthaleim in the water will turn it red, if alkali is present whilst it will remain clear is acid is present.

### Carbonic Acid.

Some limewater and hydro-cloric acid are required for this test. To ascertain if the water contains carbonic acid, pour about one inch of water into a test tube, and the same quantity of lime water. If the water contains carbonic acid, it will become milky, and on adding a few drops of hydrocloric acid, the water will become clear again.

### Sulphate of Lime.

To decide this test, some chloride of barium, and nitric acid will be required. To see if sulphate of lime (gypsum) is present, pour about one and one-half inches of water into a test tube, and add a little chloride of barium. If a white precipitate is formed, which will not dissolve when adding a little nitric acid, the water contains sulphate of lime.

### Magnesia.

To make a test for magnesia, some carbonate of ammonia, and phosphate of soda are required. Fill a test tube about one-third full at water, and bring it to a boil over a spirit lamp or bunsen burner; then add a very small amount of phosphate of soda. Set it aside for a few minutes, and if magnesia is present, it will form a white precipitate.

### Lead.

Some cochineal is required for this test. Ttake a test tube quarter full of water to be tested, add two drops of cochineal. If the water turns blue, instead of pink, it will denote the presence of lead.

### Copper.

To test for copper, a little chloride of ammonium, and some soft iron filings will be required. To make the test, pour some water into a test tube, and drop in a few iron filings, and a few drops of chloride of ammonium. If copper is present, the water will turn blue.

### Iron.

For this test, some ferrocyanide of potassium will be reqnired. Pour a small quantity of water into a test tube, and add one drop of ferrocyanide of potassium. The water will turn blue if iron is present.

### A Few Simple Tests for Sewer Gas.

Sewer gas is a mixture of several gases that emanate from decomposing animal and vegetable matter in sewers. The principal gases are sulphureted hydrogen, ammonia, and carbonic acid. A test for sulphureted hydrogen, is a piece of blotting paper dipped in a solution of plumbic acetate, which will turn black when exposed to the gas.

### Test for Ammonia Gas.

A strip of red litmus paper will turn blue or yellow, and a strip of yellow turmeric paper will turn brown when exposed to that gas. This gas will also turn limewater cloudy when passed through it.

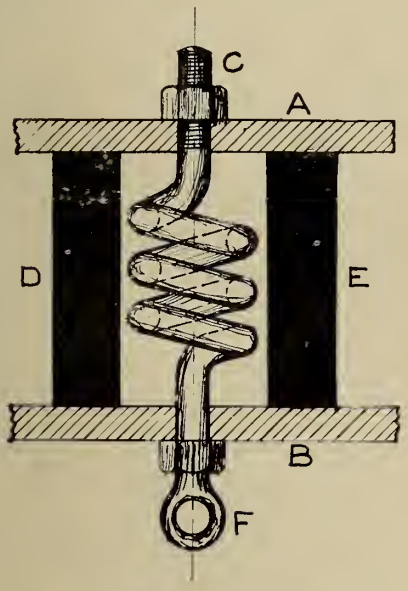
# Correspondence and Discussion on Previous Articles

Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### STEAM PRESSURE.

Sam Jones is correct in his contention that the steam pressure does not increase the tension on the cylinder studs until the pull due to the steam exceeds the initial tension on the bolt.

The enclosed sketch may perhaps be of use. A and B are the flanges, D and E are two rubber block to represent the gasket, C is a bolt connecting the flanges. Suppose the nut to be screwed up until there is a pressure of 1,000 lbs on the blocks. Now hang weights on the eye F to represent the steam pressure. It is evident that the plates A and B will continue to grip the blocks until the added weights equal 1,000 lbs., the initial tension on the bolt.




Steam Pressure.

Any further addition of weight would stretch the bolt further, and therefore increase the tension, the tension being practically proportional to the stretch of the bolt.

The sketch shows all the "springiness" in the bolt. In practice the bolt, nut, gasket and flanges would each spring to some extent.

In answer to J. W. Paylor, I have seen a cut of a boiler provided with glass insulators, special nozzle, and brush to collect sparks as suggested, but understand that the method was unsuccessful. The power contained in the steam used would probably be out of proportion to the electric power obtained. Another objection would be the high tension of the sparks. These difficulties might be overcome with more refined apparatus. It is similar to the method employed in the manufacture of lighting, but the friction of the steam on the material of the nozzle is probably a large factor in the production of electricity by the method suggested.

(3) The method proposed of stopping an engine might result in an accident due to the high compression, if the engine in question had considerable flywheel effect. Relief valves would have to be provided of considerable area. Used in connection with a reliable safety stop valve in the steam supply, it would stop an engine very rapidly.

(5) Why could not the rounded boulders mentioned have been rounded by water action and then carried by water or ice and deposited in the coal bed while in process of formation? Ice is unlikely, because the vegetation which formed the coal was tropical nature, but heavy warm rain and torrents, quite capable of transporting boulders, are typical of the carboniferous period.

In answer to L. P. Leslie, four watts per candlepower is an usual allowance. 2½ killowatts=2,500 watts. 2,500÷4=625 candle power. 625÷16=39 lamps of 16 c.p. each.

The candle power given does not vary much, provided the lamps used are suitable for the voltage employed; but it takes heavier wire to transmit the same power at lower voltage, owing to the larger flow of current.

C. C. CARISS.

---

On page 41 of the September issue of The Power House, I notice a letter from "Sam Jones" telling of a question which was up for debate at one of the sessions of C.A.S.E. local.

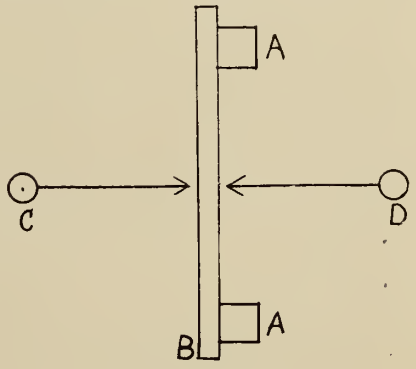
"The 10 studs of a cylinder cover are screwed up to 1,000 lbs. tension each. The area of cover exposed to steam pressure is 100 sq. inches. If steam at 80 lbs. is turned in will it make any increase in the tension on the studs?" "Sam Jones" gives it as his own opinion that the steam pressure must reach 100 lbs. per sq. inch before there will be any added tension on the studs.

Now this is a question which has caused a lot of debate and for the life of me I can't see why? To me it seems quite plain that the stud-tension increases with the first lb. of steam admitted.

One of the strongest and most often advanced illustrations used by those of "Sam Jones'" view is that shown in the illustration. A and A are two posts, B is a board not nailed to either post, C and D are men who are pressing on either side of the board B.

A and A represent the cylinder end, B represents the cylinder cover, C represents the studs and D the steam pressure. The argument is this, C presses against B with a force of 100 lbs. and as a result B presses against the two posts with a pressure of 50 lbs. each. Next, D is allowed to exert a pressure of 10 lbs. and this pressure by D is not felt at all by C. Then D exerts 50 lbs. pressure and this is not felt by C. D raises to 100 lbs. and even now C holds him without increasing a single pound. But D raises to 105 lbs. and C must now raise 5 lbs. to counterbalance him. And so the argument goes that the steam pressure must exceed the original stud tension before the stud tension will increase.

But in this, their best argument, there is a flaw, for it is plain that as D raises




Steam Pressure.

his pressure from 10 to 100 lbs. the pressure of B against AA is decreasing an amount equal to the raise. Now this is not the case in the engine cylinder and cover for the pressure of the cover against the cylinder and remains constant on account of the non-elasticity of so short a stud.

The illustration would be true if the pressure between the post and board were kept constant and in order to do that we will use two men in place of the two posts. Now the first lb. of pressure by D is felt by C who must exert 101 lbs. of pressure and when D is exerting 100 lbs. C must exert 200 lbs. Internal pressure does not affect the pressure with which the cover is held against the cylinder end, but only adds to the pressure of the cover against the stud heads.

On the other hand internal vacuum does not affect the pressure between the stud heads and the cover but does add to the pressure of the cover against the cylin-

der end. With 100 lbs. per sq. inch in the cylinder there would be 10,000 lbs. pressure against the cylinder side of the cover. Then there would be also against that same side of the cover, the pressure of the cylinder end amounting to another 10,000 lbs. makiag a total pressure on that one side of the cover of 20,000 lbs. Now it is perfectly clear that this total pressure must be counterbalanced and there is nothing to do it with except the studs. Therefore they must take 2,000 lbs. each or double the tension to which they were originally screwed up. Any other conclusion would be grossly contrary to the laws of mechanics. There simply must be as much pressure on one side of the cover as on the other without any regard as to what exerts the pressures ; be it steam, stud heads or joint pressure.

R. MANLY ORR.

---

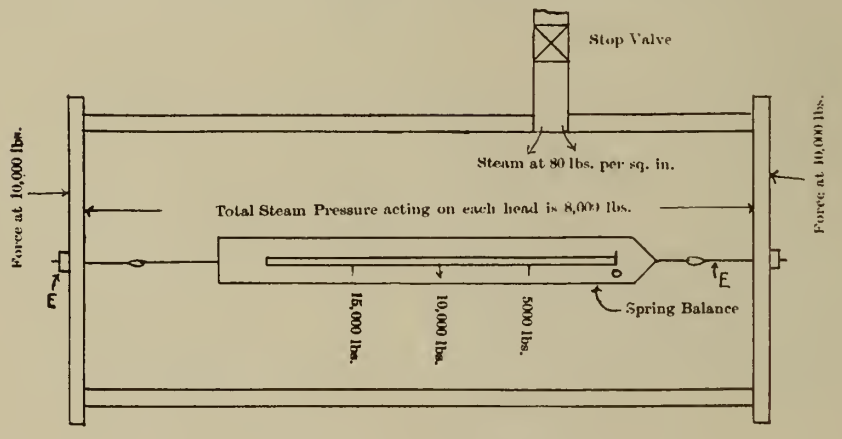
The question raised by Sam Jones on page 42 of the September number regarding increase of tension on cylinder head studs when steam under pressure of 80 lbs. per sq. inch is admitted to cylinder, is one that should be of general interest to engineers.

This particular question in mechanics has caused considerable difference of opinion among engineers as a body, and some friends of mine have at various times presented pretty good arguments in favor of "increase of tension."

The enclosed sketch represents my theory of the problem, and while I, like others who each believe himself to be right, think the solution will prove the contention, yet I am open to conviction and criticism.

Until such time as the total steam pressure on the inside of the head equals the total pressure due to the nuts being tightened on the outside of the head, I fail to see how there can be any increase of tension on the studs. In the case under discussion the external force on the heads is 10,000 lbs. or. each ; while the internal force on each head with steam at 80 lbs. per sq. in. would be 80 x 100 (sq. ins.) equal 8,000 lbs.

Referring to the sketch, it will be seen that instead of securing the heads to the cylinder by studs in the usual way, I have assumed them to be tightened in place by means of two central eye-bolts E E between which is fastened a powerful spring-balance. Now suppose that the eye-bolt nuts be tightened up until the spring-balance shows a tension of 10,000 lbs. ; perhaps a little imagination will be needed to see what pull is registered on the scale, but this could be overcome if necessary by putting glass peep-holes in the side of the cylinder for the use of those "from M ssouri." Proceeding with the supposition it will be granted by the most skeptical, I think, that no more tension can be placed upon the eye-bolts without showing an increased tension on the spring balance ; and also conversely that the latter can register no increase of tension unless there be an addition of force acting to further separate the eye-bolts and thus extend the spring-balance.




Steam Pressure on Cylinder Heads.

Now keeping these two facts firmly in mind, consider the stop-valve in the steam inlet pipe to be opened and steam admitted at 80 lbs. per sq. in. The total force of the steam acting upon each head will then be 8,000 lbs. or 4 tons ; but as the heads are held in place by a force of 10,000 lbs. or 5 tons, it can readily be seen that the internal force would have to be increased by a shade over 1 ton before any movement of the index of the spring-balance could take place. If this were not the case, it would be an instance of a less force overcoming a greater.

The cylinder in the sketch could be assumed to be a large safety-valve, which as soon as the contained steam exceeded 100 lbs. per sq. in. would allow one of the heads to move outward a little from the cylinder and thus provide an automatic relief from excess pressure.

J. A. CARRUTHERS.

## CAPACITY OF DYNAMO.

On page 42 of the September issue of The Power House, Mr. Leslie asks a couple of electrical questions, viz.,—"What is the capacity of a 2½ k.w. dynamo at 110 volts in 16 candle power lights?" and also, "Does a k.w. furnish a candle-power regardless of voltage and amperage?"

My experience has led me to believe that about sixteen (16) ordinary 16 c.p. lights per k.w. is a fair approximate estimate where transmission is short. However, the number carried per k.w. will vary with the efficiency of the lamp. For instance, the watt consumption of an ordinary carbon-filiment lamp varies from 3.1 to 4 watts per candle-power; while the more recent metallic filiment lamp, such as the "Osmium" and "Tungsten," requires only about 1.5 watts and 1 watt per c.p., respectively.

Considering the more comomn carbon lamp, a fair average watt consumption would be 3.5 watts per c.p., and this would give $3.5 \times 16 = 56$ watts per light of 16 c.p. Hence, following the problem out "on paper," the capacity of a 2½ k.w. dynamo would be $2500 \div 56 = 44$ (about) 16 c.p. lights.

Computing the number approximately at 16 lights per k.w., the total number carried would be $16 \times 2.5 = 40$ lights.

Re Mr. Leslie's second question, the matter may show up clearer to him if he remembers that watts are the product of volts and amperes, and that at the ordinary voltage of 110 to 112, each 16 c.p. light requires about ½ an ampere; while at the old-time voltage of 50 to 55, each lamp required about 1 ampere. In each case, it will be seen that in the neighborhood of 55 watts were required per lamp.

So that within practical limits it may be taken that the voltage and amperage can be changeable factors, as regards candle-power, always providing the lamps used are intended for the voltage carried. Otherwise there will be either a mighty poor light for a long time, or else a mighty brilliant light for a short time.

J. A. CARRUTHERS.

---

Please find enclosed the sum of $1 in post office order for The Power House Journal. I think it is a great help to one.

Has anyone used common molasses or black strap as a compound for removing scale? I have been told that it is all right.

J. S. HUNTER.

---

The Philip Carey Co., manufacturers of Flexible Magnesia Cement Roofing and Asbestos coverings, have opened an office in the Citizen Building, Ottawa. G. Dingwell is in charge.

# Society Officers

**Canadian Society of Stationary Engineers.**

Presldent, Charles Kelley, Chatham, secretary, W. A. Crockett, Mount Hamilton P.O., Ont.

**Toronto Rranch C.A.S.E.**

Meetings 1st and 3rd Fridays each month at Forum Hall, corner Gerrard and Yonge Streets. President, W. C. Tait ; secretary, A. Kirby.

**C.A S.E. Exhibitors' Association.**

President, W. R. Stavert, Jenkins, Montreal ; secretary, John B. Goff, Dart Union Co., Toronto ; assist. sec., G. C. Keith, editor The Power House, Toronto.

**Canadian Society of Civil Engineers.**

Rooms at 413 Dorchester Street West, Montreal. President, Geo. A. Mountain ; secretary, Prof. C. H. McLeod. Meetings will be held at Society Rooms each Thursday.

**Quebec Branch of C.S. of C.E.**

Chairman, L. A. Vallee ; secretary, Hugh O'Donnell, P.O. Box 115, Quebec. Meetings held twice a month at Room 40, City Hall.

**Ottawa Branch of C.S. of C.E.**

Chairman, C. R. Coutlee, Box 560, Ottawa ; S. J. Chapleau, Box 203.

**Toronto Branch of C.S. of C.E.**

96 King Street West, Toronto. President, J. J. G. Kerry ; secretary, E. A. James, 62 Church Street.

**Manitoba Branch of C S of C.E.**

Chairman, H. N. Ruttan ; secretary, E. Brydone Jack. Meets first and third Friday of each month, October to April, in University of Manitoba.

**Vancouver Branch of C.S. of C.E.**

Chairman, Geo. H. Webster ; secretary, H. K. Dutcher, 40-41 Flack Block, Vancouver. Meets in Engineering Department, University College.

**Nova Scotia Society of Engineers, Halifax.**

President S. Fenn ; secretary, J. Lorne Allan, 15 Victoria Rd., Halifax, N.S.

**Canadian Electrical Association.**

President, N. W. Ryerson, Niagara Falls ; secretary, T. S. Young, Canadian Electrical News, Toronto.

**Universal Craftsmen Council of Engineers. Canada Council.**

Chief, Chas. Mosley, 7 Charles St. W.; secretary, H. E. Terry, 157 Bay St. Meets second Tuesday in each month in Room 2, 4th Floor, Temple Building.

**Toronto Branch A I.E.E.**

Secretary, W. H. Eisenbeis, 1207 Traders Bank Building.

**Engineers' Club of Toronto.**

96 King Street West. President, A. B. Barry; secretary, R. B. Wolsey. Meetings every Thursday evening during the fall and winter months.

**Edmonton Engineering Society.**

President, Dr. Martin Murphy ; secretary, B. F. Mitchell, City Engineer's office, Edmonton, Alta.

**Canadian Railway Club, Montreal.**

President, H. H. Vaughan ; secretary, James Powell, Box 7, St. Lambert, near Montreal. Meetings at Windsor Hotel, 1st Tuesday of each month, except June, July and August.

**Central Railway and Engineering Club, Toronto**

President, C. A. Jefferies ; Sec.-Treasurer, C. L. Worth, Room 409, Union Station. Meetings at Prince George, 3rd Tuesday of each month, except June, July and August.

**Western Canada Railway Club.**

President, Grant Hall ; secretary, W. H. Rosevear, 199 Chestnut Street, Winnipeg, Man. Meetings second Monday, except June, July and August, at Winnipeg.

## CENTRAL RAILWAY AND ENGINEERING CLUB.

The regular monthly meeting of the Central Railway and Engineering Club, Toronto, was held in the Prince George Hotel, on Tuesday, Sept. 21. A paper was read on "Care and Washing out of Locomotive Boilers," by J. V. Jackson, boiler inspector, G.T.R., Montreal. The paper showed the difficulties to be overcome and gave the easiest and quickest way to clean locomotive boilers. Mr. Jackson pointed out that boiler scale not only greatly increased the fuel bill, but when the scale was heavy became a source of danger. He recommended frequent cleaning of boilers.

President, C. A. Jeffries, master mechanic, Consumers' Gas Co., occupied the chair.

The next meeting is on Tuesday, Oct. 19, when Mr. Shales, of the Elevator Specialty Co., Toronto, will read a paper on "Care and Maintenance of Elevators."

## N. S. SOCIETY OF ENGINEERS.

At the annual meeting of the Nova Scotia Society of Engineers, held in New Glasgow, Sept. 9 and 10, and reported in the September issue of The Power House, the following officers were elected for the ensuing year:—

Pres.—S. Fenn, Halifax.

First Vice-Pres.—J. A. Stairs, New Glasgow.

Second Vice-Pres.—J. W. McKenzie. Halifax.

Secretary—J. Lorne Allan.

Council—District No. 1, Prof. R. R. Keeley and A. R. McCleave, Halifax. District No. 2, H. C. Burchell and D. McD. Campbell, Syndney. District No. 3, J. G. McKenzie, Westville, and A. G. Robb, Amherst. District No. 4, G. M. Archibald, Torbrook, and N. G. Yorston, Truro.

## TORONTO ENGINEERS' CLUB.

The following is the program for October meetings to be held in the rooms, 96 King Street West, Thursday, Oct. 14—"Engineering Laboratories and workshops in Europe," by Prof. R. Angus, illustrated with lantern slides.

Thursday, Oct. 21.—"The air as a medium of Transportation," paper, by J. F. d'Almeida.

Thursday, Oct. 28.—Meeting of Toronto branch of Canadian Society of Civil Engineers.

## S. P. S. ENGINEERING SOCIETY.

The first meeting of the Engineering Society of S. P. S., Toronto, for the present session was held on Wednesday afternoon, Oct. 6. President Black was in the chair and gave the opening address. A graduate of the school, W. J. Francis, C.E., of Montreal, gave a splendid address on "Character, Training and Personality in the Work of the Engineer."

## A "BACK TO MONTREAL" FLOAT.

In the trades' procession in Montreal during "Back to Montreal" week one of the floats that attracted considerable attention was the one shown in the accompanying illustration. It consisted of a cone of leather belting resting on a carpet of lace leather. The main feature was the means of locomotion, which was two "steer power." These steers were covered with a white blanket marked so as to display the parts of the hides used in making the D. K. McLaren belting. The animals seemed to enjoy (?) the procession as much as the onlookers.

"Back-to-Montreal" Float of D. K. McLaren's, Montreal.

# CANADIAN MACHINERY AND MANUFACTURING NEWS

A monthly newspaper devoted to machinery and manufacturing interests mechanical and electrical trades, the foundry, technical progress, construction and improvement, and to all users of power developed from steam, gas, electricity, compressed air and water in Canada.

## The MacLean Publishing Co., Limited

*JOHN BAYNE MACLEAN, President* — *W. L. EDMONDS, Vice-President*
H. V. TYRRELL, Toronto - - Business Manager
G. C. KEITH, M.E., B.Sc., Toronto - Managing Editor
F. C. D. WILKES, B.Sc., Montreal - Associate Editor

OFFICES:

**CANADA**
MONTREAL Rooms 701-702 Eastern Townships Bank Bldg
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Building Phone 3726 F. R. Munro
BRITISH COLUMBIA - Vancouver R. Bruce Bennett, 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
NEW YORK - - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone, 1111 Cortlandt

**PARIS**
FRANCE John F. Jones & Co., 31bis, Faubourg Montmartre, Paris, France

**SWITZERLAND**
ZURICH - - - Louis Wol Orell Fussli & Co

Cable Address:
Macpubco, Toronto. Atabek, London, Eng.

SUBSCRIPTION RATE.

Canada, United States, $1.00, Great Britain, Australia and other colonies 4s. 6d., per year; other countries, $1.50. Advertising rates on request.

**Subscribers who are not receiving their paper regularly will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.**

Vol. V. October, 1909 No. 10


## CONTENTS


Boiler Feed Water and Its Treatment 25
The Cold Water Delusion - - - - - 26
The Steam Trap: An Important Economy in the Power Plant - - - - 27
How an Automatic Feed Water Regulator Overcame Difficulties in the Power House - - - - - - - - - 30
Various Types of Refrigerating Machines - - - - - - - - - - - 31
Heating Feed Water - - - - - - - 32
Some Features in the Consideration of Condensers - - - - - - - - 33
Electricity From Sun's Rays - - - - 38
Europe's Water Power - - - - - - 38
Practical Information About Automatic Injectors - - - - - - - - 39
Setting Valves on the Ideal High Speed Steam Engine - - - - - - 40
Setting and Operating the Steam Pump - - - - - - - - - - - 42
Practical Articles by Our Readers - - 43
Experience On the Road.
Jack Tells Jim How to Find the Height of a Smokestack.
Feed Water Required by Small Engines.
A Simple Indicator Reducing Rig.
Avoidance of Vibration and Noise.
Unique Engine Using Air and Steam.
Increasing the Efficiency of Power Plants.
Some Useful Devices.
Testing the Expansion Curve.
Simple Tests for Determination of Foreign Matter in Water.
Correspondence - - - - - - - - - 49
Steam Pressure.
Capacity of a Dynamo.
Societies - - - - - - - - - - - 51
A "Back-to-Montreal" Float - - - 51
Editorial - - - - - - - - - - - 52
New Equipment - - - - - - - - 55
"Ideal" Open Feed Water Heater.
Transverse Current Water Heater.
Dart Flange Unions.
Dick, Kerr Interpole Motor.
New Type Ferranti D.C. Meter.
The Laugh Department - - - - - 58
Power Plant Developments - - - 60
To Figure the Saving Made by Tungsten Lamp - - - - - - - - - 61
Power Supply Markets - - - - - - 61


## TREATMENT OF BOILER FEED WATER.

The demand for information on boiler feed water, its treatment and the machinery, such as pumps, traps, injectors, heaters, condensers, etc., used in connection with feeding water, has led us to devote the October issue of The Power House almost wholly to this subject. Engineers are calling for assistance in their trouble with bad feed water, and we trust each reader will find something of value in this issue.

Engineers are more or less familiar with mechanical devices, such as heaters, purifiers, skimmers, etc., and their workings, but the chemical treatment of water is making advances and engineers should be familiar with it as well.

There is one point that every engineer, who wishes to treat the boiler feed water chemically, must remember—beware of "stock" compounds. Feed water varies. Waters in Alberta and Ontario give different analyses. In fact, water of the same river taken one hundred miles apart give different analyses. The only proper and scientific method in the chemical treatment of feed waters, therefore, is to have an analysis made and obtain a compound specially prepared for the feed water to be treated. The "penny wise and pound foolish" operators, who have used stock compounds and did not get satisfactory results, get what they deserved, and will get no sympathy here. The right way is the common sense, scientific way. When the feed water gives trouble, consult a specialist, get at the foundation of the trouble, and then take the proper steps to eliminate that trouble. There are many honest manufacturers who thoroughly understand boiler feed water treatment and every well-regulated power plant, where efficiency is a factor, should consider carefully the subject of feed water and methods of treating to eliminate all possible loss.

## VALVE SETTING.

In this issue we give the fourth of a series of articles on setting the valves of engines, on the Canadian market. The first article appeared in May and dealt with the Robb-Armstrong Corliss. The second appeared in June and described the valve setting of the Waterons engine. The third, in July described setting the Wheelock engine valves. These will be continued for some months and is a most important series of articles.

Valve setting is one branch of knowledge in the engineer's vocation the importance of which cannot be overestimated, says the editor of Power and the Engineer. If a man knows how to set the valves on an engine he understands how the steam will be distributed in the cylinder under all conditions of load and steam pressure, as well as the effect of apparently minor and unimportant departures from correct practice.

Standard engines are expected under ordinary working conditions to give the best results as to steam economy when the cutoff takes place at or near one-fourth stroke and, with the valve setting recommended by the builder, will operate satisfactorily carrying the load for which the engine was designed. But engines are frequently called upon to carry either continuously or intermittently much heavier loads than those for which they were designed and it is under such conditions that an intelligent departure from standard or conventional practice often allows the carrying of double or more the load for which the engine was designed, if not with a fair degree of economy certainly without decrease of economy at the average rated load.

In one instance a one-hundred-fifty-kilowatt generator was coupled directly to the shaft of a 16x36-inch Corliss engine running at one hundred revolutions per minute. The average load on the generator was seventy-five kilowatts, at which load the operation of the engine was satisfactory and the speeds regular, but at times an increase of fifty kilowatts was suddenly thrown on, with the result that the regulation was poor and the operation highly unsatisfactory. When the facts in the case were laid before the builders of the engine and advice asked for as to the best course to pursue, the owner was promptly told that the engine was too small for such a load and that only a larger engine would operate satisfactorily under such conditions.

One evening the question of the unsatisfactory operation of this engine was discussed at the meeting of the engineers' association and an engineer present suggested a change in the valve setting, and after some discussion volunteered to improve the condition. The following Sunday was selected for the attempt. On removing the valve-chamber covers the steam valves were found to have three-

eighths of an inch lap and the exhaust valves one-eighth. It was also discovered that the collar on the governor shaft must rise fully one inch before the releasing cams became operative.

In resetting the valves one-eighth-inch lap only was given to the steam valves, while the exhaust valves were left "line and line," as the expression is, or with neither lap nor lead. Then the regulator was blocked up three-sixteenths of an inch from the stop and the releasing-cam rods so adjusted that the head-end valve would trip at the extreme travel of the motion plate and the crank-end-valve hook would touch the cam but not release. On the next day the valve setting, after the slight adjustment suggested by the indicator diagram, was tried out, with the result that the engine carried with apparent ease all of the load that could be put on it, and the fact that the regulation was not all that could be desired was due to a rather light flywheel and to the fact that the governor ran much slower than the engine, instead of faster than the engine as it should.

An intimate understanding of the principles of valve setting is not beyond the attainment of the commonest engineer and none should be satisfied with less than a complete mastery of the subject.

## NEW MACHINERY HALL FOR THE CANADIAN NATIONAL EXHIBITION.

The Exhibition Board of Directors are recommending to the Toronto City Council that a by-law for $320,000 be submitted next January to provide needed buildings and other improvements at the Fair during the next three years. The buildings recommended are as follows: Live Stock Arena, $110,000; Machinery Hall, $75.000; Women's Building, $60,000; Poultry Building, $30,000; Dog Building, $25,000; Lavatory accommodation, $20,000; Women's rest building, $7,000; Band Stand, $350.

It will be noted that a Machinery Hall is included in the estimates and it is sincerely hoped that another year will see a new building with proper facilities for handling heavy machinery. We have passed the stage when only popular taste must be catered to. Machinery Hall should be educative, and it will be, when there are facilities and available space. We are planning to spend large sums on technical education. With a new Machinery Hall, the machinery exhibit will be one of the best educational features of the Exhibition.

## UNIFORM BOILER LAW.

That a uniform boiler law would be advantageous to all consumers and manufacturers of boilers, is being recognized by those in authority in the various provinces. The provinces have full control over stationary boilers, and it makes the subject of uniform regulations a rather complex one. The scheme being followed by the manufacturers is to have a board, composed of a representative from each province, meet and discuss the situation, and agree to uniform regulations, which they would recommend the various provinces to adopt. J. W. Harkom interviewed the men in charge of boiler inspection and construction in the several provinces, and at a meeting of the combined engine and boiler, and engine and thresher sections of the C. M. A., held in Hamilton, Sept. 15, reported that this would probably lead to the elimination of the difficulty. Ontario will appoint a man; British Columbia will do likewise; Quebec, usually a leader in progressive legislation, will, no doubt, also appoint a man and all the other provinces should see the wisdom of it. and join forces for uniform legislation and thus promote inter-provincial trade.

At the present time manufacturers of boilers make one boiler for Alberta, another for British Columbia, etc., and legislators should see the reasonableness of having uniformity in construction and inspection, and assist in the carrying out of a reform which will be clearly beneficial to every province.

The Canadian Manufacturers' Association, recognizing the importance of uniform boiler regulations, and seeing the benefit to be derived therefrom by both manufacturer and consumer, passed the following regulation:

> "Whereas, the several provinces, under the powers vested in them, have in the past formulated regulations governing the construction and inspection of boilers;
>
> "And whereas, owing to the fact that each province, through its staff acting alone, the resulting regulations differed in many respects, causing much confusion, annoyance, and loss to user and builder;
>
> "And whereas, uniform regulations providing for the safety of the public, including users and builders, are highly necessary and desirable;
>
> "Be is resolved, that the Canadian Manufacturers' Association in annual convention assembled does herein urge the different Provincial Governments to accept the principle of uniformity, and to adopt the suggestion offered that a conference of representative officials from the several provinces be held in such place as may be found convenient at the earliest possible date to make recommendations for a uniform measure of this mature."

The results of uniformity will be two-fold: (1) The manufacturer will be able to build a number of boilers on the same pattern, allowing him to manufacture a better boiler at less cost, doing away with the numerous patterns, templets, etc. (2) The consumer will know that he is getting a boiler that can be used in any province, besides sharing in the decreased cost of production. By all means, let us have uniform boiler regulations in the several provinces.

## GRADED CERTIFICATES.

The subject of graded certificates is a live one among stationary engineers. At the present time in Ontario, engineers, whether in charge of plants of 50 or 500 h.p., have the same certificate. To eliminate this, the C.A.S.E. at their convention in London in July drew up the following resolution:

> "Whereas, it is found expedient that a graded certificate be granted to engineers of the Province of Ontario;
>
> "Whereas, the power to pass legislation to govern the same is vested in the Provincial Legislature;
>
> "Whereas, as every engineer has, or should have, a provincial certificate or license, and as the same is not graded, an amendment should be made to the 'Act respecting Stationary Engineers,' so as to show the capabilities of the engineer to the manufacturers;
>
> "Whereas, that the certificates so granted be graded as 1st, 2nd and 3rd;
>
> "Whereas, that the examination for same above the lowest grade be optional with engineers;
>
> "Therefore, be is resolved:

"That this association petition the Ontario Government to amend the 'Act respecting Stationary Engineers' by granting graded certificates so as to protect the manufacturers of the province;

"That this association petition the Ontario Government to invest the Board of Examiners with full power to enforce the 'Act respecting Stationary Engineers';

"That a copy of this resolution be sent to the Honorable the Minister of Agriculture for Ontario and to the chairman of the Examining Board, under said Act."

In some of the other provinces, such as British Columbia, graded certificates are used. In Manitoba it is proposed to use Ontario's Act and regulations, except that the certificates will be graded. The abilities of engineers to take charge of large plants should be recognized in some way, and the graded certificate is one solution.

## THE SECRET COMMISSIONS ACT.

To prevent the payment or acceptance of illicit or secret commissions, an Act has been passed by the House of Commons at Ottawa, amended and approved of by the Senate, and is now in force. It is to be known as The Secret Commissions Act, and is applicable to the business of travelers or agents and manufacturers who employ them.

The Act is known as Bill 31, and reads as follows:

Everyone is guilty of an offence and liable upon conviction on indictment to two years' imprisonment, or to a fine not exceeding two thousand five hundred dollars, or to both, and, upon summary conviction, to imprisonment for six months, with or without hard labor, or to a fine not exceeding one hundred dollars, or to both, who,—

(a) being an agent, corruptly accepts or obtains, or agrees to accept or atempts to obtain, from any person for himself or for any other person, any gift or consideration as an inducement or reward for doing or forbearing to do, or for having after the passing of this Act done or forborne to do, any act relating to his principal's affairs or business or for showing or forbearing to show favor or disfavor to any person with relation to his principal's affairs or business; or,

(b) corruptly gives or agrees to give or offers any gift or consideration to any agent as an inducement or reward or consideration to such agent for doing, or forbearing to do, or for having, after the passing of this Act, done or forborne to do, any act relating to his principal's affairs or business, or for showing or forbearing to show, favor or disfavor to any person with relation to his principal's affairs or business; or,

(c) knowingly gives to any agent, or, being an agent, knowingly uses with intent to deceive his principal, any receipt, account, or other document in respect of which the principal is interested and which contains any statement which is false or erroneous or defective in any material particular, and which, to his knowledge, is intended to mislead the principal.

(d) Every person who is a party or knowingly privy to any offence under this Act shall be guilty of such offence and shall be liable upon conviction to punishment hereinbefore provided for by this section.

The latter clause was an amendment to the original bill, which passed the Senate on March 31st last. After being amended it was sent back to the House of Commons and agreed to on April 21st, and was finally sanctioned by the Senate.

### The Practical Meaning.

The Secret Commisions Act, as its name infers, prevents the giving of secret commissions, rebates, or considerations.

A traveler who sells an article to a company or engineer, cannot legally give that company or engineer any secret rebate or commission to induce either of them to purchase from him, nor can the engineer accept a secret rebate. If the goods are sold for less than the manufacturers' price in the ordinary way, the sale will, of course, be legitimate in the eyes of the law; but if the goods are sold for the manufacturers' price and the salesman puts his hand in his pocket and gives a rebate or commission to the engineer, then the sale is illicit and that salesman, if convicted, is liable to imprisonment for two years, or to a fine not exceeding $2,500, or both, as mentioned above.

One way that this has been done in the past was by the agent or traveler giving an engineer the secret rebate in order to get his business and then charging up the rebate to his employer or the firm he represented as road expenses. The new bill makes such an act contrary to the criminal code.

In the event of the traveler or agent selling below the manufacturers' price and doing so openly that traveler or agent does not commit a breach of the law. The manufacturer, however, has the privilege of determining to whom his goods shall be sold and at what price, and in such a case, if he desires, may refuse his goods to the house whose travelers or agents cut down his price.

### An Example.

To take a hypothetical case, let us assume that a certain traveler wishes to "get in right" with the engineer and have him recommend his motor, his brand of lubricating oil, packing or whatever it may be, secretly gives him a V; or, knowing he will have some difficulty dealing with the company, gives a rebate to get the business. He then charges the rebate to hotel or some other expenses, and gets his money back from his firm.

This system is sometimes used by a house anxious to get business and when the traveler for the house who does business "on the square" comes along, he finds he is up against a competition that he cannot legitimately meet.

Clause (d) in the above bill is the amendment that was made to it after it had reached the Senate. It makes the purchaser just as liable as the traveler or house he represents who is guilty of a breach of the Act.

A similar Act is in force in Great Britain, and any attempted evasion of the law is severely dealt with. The law is timely in Canada, and it is hoped it will stop the practice of unfair and dishonest methods of getting business.

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### "IDEAL" OPEN FEED WATER HEATER.

A new feed water heater known as the "Ideal" open feed water heater, purifier and oil extractor, has been placed on the market by the Goldie & Culloch Co., Galt, Ont. It is of the open or exhaust steam type and is intended to extract the oil and grease from the exhaust steam as well as take out at the same time the carbonate scale-forming matter from the feed water and deliver the feed water at nearly boiling temperature.

By reference to the following illustrations the action of the heater will be clearly understood.

The exhaust steam enters the bottom of heater at inlet "1," striking the oil extracting deflecter "2" in chamber "A," which is drained by open drip pipe "3" to sewer. Steam passes out of this chamber up tube "4," discharging into chamber "B," there mixing with the descending water from filter "F," then into chambers "C" and "D" through tubes "5" and "6," in both chambers mixing with the spraying water, and after that passes through the opening at "7" to the heating coils or atmosphere.

Cold water is admitted at supply pipe "8" and sprayed into chamber "D." Here it falls through the steam, gathering heat from it, and is distributed over filter bed "E," where it percolates through about 18 or 20 inches of excelsior. At the bottom of this material two to six layers of burlap are placed, through which the water filters into chamber "C" in a fine spray, again mixing with the steam, the same process being repeated through filter bed "F" into chamber "B." The water then passes down tube "G" into chamber "H," rising through burlap and coke to the pure water hot well "J."

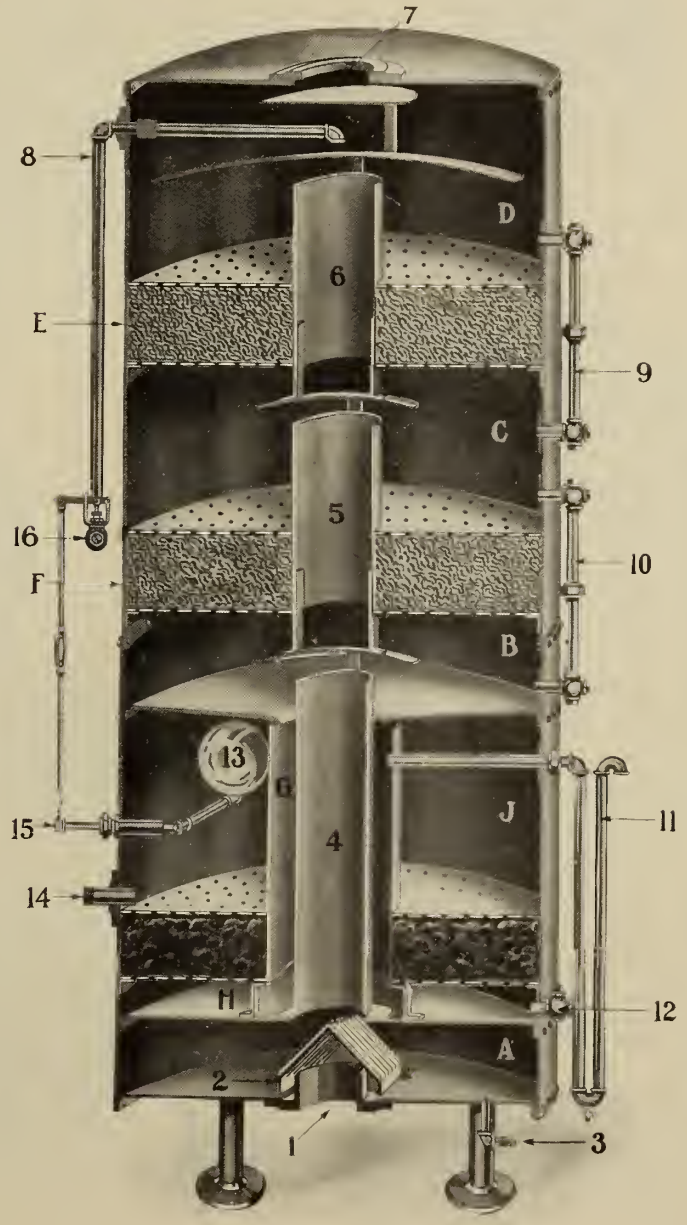
Referring to the numbers on illustration "9" and "10" are by-pass pipes useful only if filter beds become clogged or overcharged; "11" is the overflow and scum pipe which should discharge into a funnel connected to the sewer; "12" is the blow off cock; "13" is the float regulating the rate of feed; "14" is the suction pipe to be connected to pump; "15" is the float handle; "16" is a double seated balance valve for regulating water supply.

The following points are given to ensure the successful operation of the heater:—

Care should be taken that the drip pipe "3" does not become clogged.

The scum should be run off the water at least once every ten hours. This can be done by pressing down handle "15" till the water rises to about the top of the gauge glass when it will be high enough to run out overflow pipe "11."

The excelsior filter beds should be removed and fresh put in as found necessary. The frequency of this will depend on the quality of water used. They should be examined not later than two weeks after starting up the heater and after that as experience dictates.




Goldie & McCulloch Heater.

### TRANSVERSE CURRENT WATER HEATER.

The Transverse Feed Water Heater is a new device made by the Riblet Co., Erie, Pa., which may be used in connection with the exhaust from both steam and gas engines.

Only about 30 per cent. of the heat value of the gas is realized in develop-

ing power in a gas engine, the balance being wasted through the exhaust and the water to cool the engine. Much of heat usually lost in the exhaust may be saved, as well as that from the jacket water, and utilized for heating water for whatever purpose desired in a fae-

Riblet Transverse Heater.

tory, hotel, office-building, or laundry, by means of a Transverse Current Heater.

As a boiler feed water-heater the heater has the advantages of being made entirely of cast iron, which has little tendency to corrode or be affected by electrolysis or acids. The heater has a number of interesting features, having no tubes to collect scale, no internal joints to leak, no floats or valves to require attention, and the water does not come in contact with the exhaust. Scale does not readily adhere to the cast iron, but since the water passages are always accessible by removing the circulation plates they can be easily cleaned of any sediment that an occasional flushing out fails to remove.

The heater consists of a series of flat rectangular passages of sufficient number to give the required heating surface. the exhaust and water passages, alternating and extending transversely to each other, but with their walls integral, and the whole cast in a solid sections. To this section are bolted the circulation plates, which direct the course of the exhaust and water through their respective passages. The exhaust enters the heater at the bottom, passes through a sufficient number of ports at one time to avoid material back pressure on the engine, and goes back and forth through the heater from three to five times before reaching the exhaust outlet at the top. The water enters the heater at the top, goes through only one passage at a time, travelling downwardly in a transverse and reverse direction to that of the exhaust, and in this way the hottest water, just as it leaves the heater at the bottom, passes through the section heated by the hottest exhaust. When more convenient for instalation, this order can be reversed without interfering with the circulation.

It is stated that the heater has been thoroughly tested out for several months in connection with both steam and gas engines, with highly satisfactory results, and has recently been approved by the United States Steamboat Inspection Service.

---

## DART FLANGE UNIONS.

At the C. A. S. E. convention held recently at London, flange unions, exhibited by the Dart Union Co., Toronto, came in for considerable favorable comment. The accompanying illustration gives a very good idea of them.

One of the features of the flange coupling is the heaviness in design. They are constructed on the same principle as the regular Dart union, with the two bronze seats, forming a good joint broze against bronze, which will not be corroded or rusted away. Having the bronze joint, no packing of any character is used.

These flange couplings are used by such large companies as Armour, Pullman and Chicago Railway Co., etc. Tests show that they do not leak whether in or out of line. This new line of flange couplings has been added to the list manufactured by the Dart Union Co., 93-97 Niagara St., Toronto.

Dart Flange Unions.

## DICK, KERR INTERPOLE MOTOR.

The requirements of modern electric tramway practice are much more exacting than those of earlier years, and to meet them necessitates special apparatus. With a view to meeting these onerous conditions, Dick, Kerr have developed a series of "Interpole" motors, embodying a number of new points in design and construction which make the motor superior to the older type for certain conditions. Such motors are particularly suitable for tramway systems where extensive use is made of electric braking, and in any circumstances where the duty is more than ordinarily heavy. They are sparkless under all loads, cool in operation and oil-proof.

Sparkless commutation is ensured by the addition of interpoles, thereby increasing the overload capcity and reducing the wear of the commutator and brushes ; in some cases the motors will stand as much as 100 per cent. overload without injury. Further, the reduced wear of commutator and brushes, combined with improved methods of ventilation, results in the motor being very clean running and free from flashing over and kindred troubles.

The field frame is made in the usual form of two bowl-shaped castings of high permeability soft steel, thereby securing the smallest possible weight.

Each armature bearing box is con-

tained in a separate solid casting independent of the main motor frame altogether, and is held in position in the main motor frame by means of a tongued and grooved joint, and firmly fixed by studs. The armature can, therefore, be lowered with the bottom half for inspection, or can be retained in position in the top half, as may be desired. It can further be removed from the main shell with its bearing boxes complete, if occasion requires it.

Dick, Kerr Interpole Motor.

A malleable iron door is fitted in the upper half of the frame for the purose of inspection and adjustment of the brushes.

The field coils are machine-wound upon formers, and are made up of high-quality copper wire of square section, double-cotton and asbestos covered. The coils are then immersed in an insulating compound in order to fill all the interstices, and baked. A thick covering of combined mica, paper and cloth insulation is applied to the outer surface of the coil, and the whole taped over with strong braided webbing. Finally, the complete coil is treated with a special compound and again baked, which renders it impervious to water.

The interpoles are solid steel, fitted symmetrically between the main poles and fixed in position by rivets. The interpole field coils are clamped in position by independent screws, which are properly locked to prevent any movement. The ends of all field coils are finished off with strong bronze terminals for interconnection after they are assembled in the motor frame.

The armature core is built up of thin sheet steel discs punched from special grade steel, each lamination being covered with insulating lacquer. They are assembled directly on the shaft in sections with distance pieces which admit of free circulation of air through the core, the whole being securely keyed to the shaft. The laminations are held in position by strong end plates. The number of turns per coil varies according to the speed and output of the motor. The coils, which are machine-wound and interchangeable, are made from 100 per cent. conductivity copper, double cotton and asbestos covered. Three coils are laid together and encased in mica and paper insulation, which is then covered with layers of thin webbing, the whole being dipped and baked. Each separate coil end is indicated by a color to facilitate connecting up to the commutator. The armature core is slotted at its peripery to receive the coils.

These motors are handled in Canada by Chapman & Walker, corner Victoria and Lombard Sts., Toronto.

---

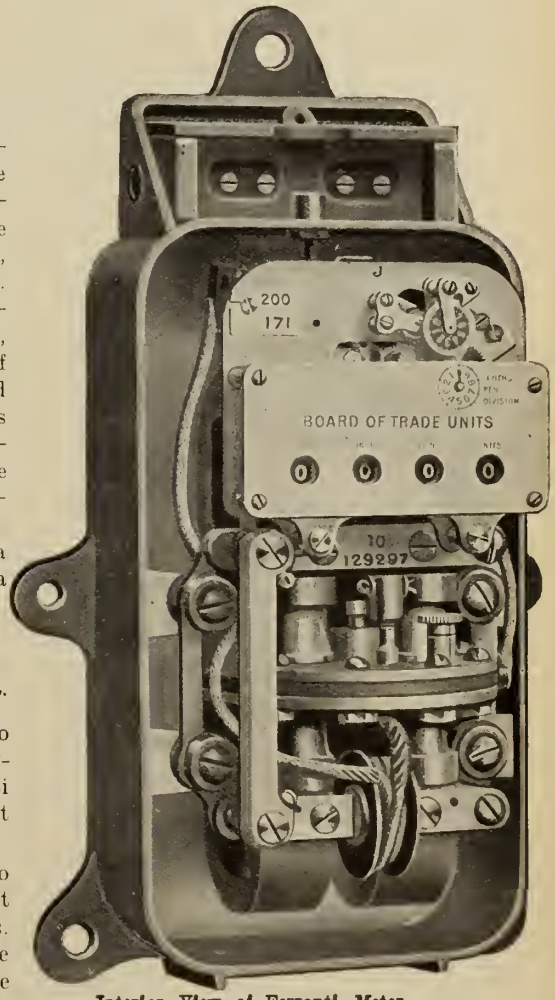
## NEW TYPE FERRANTI D. C. METER.

Motor meters can be divided into two classes, the commutator and the mercury types. The new D. C. Ferranti meter is of the mercury type without brushes or commutator.

A copper disc is used and is caused to rotate by the interaction of the current and the magnetic flux through the poles. The motion of the disc between the poles sets up an eddy current in the disc in proportion to the speed, but as the driving force is proporttional to the current, it follows that the speed is proportional to the current. This is strictly correct if frictional resistance can be neglected. To overcome the effect of mercury friction which increases with the speed, the driving force is increased by passing the current round a small coil. This causes magnetic flux from this coil to increase the flux of the driving poles, but as both pairs of poles have a retarding effect and one is increased and the other decreased by the same amount, the total retardation is unaffected.

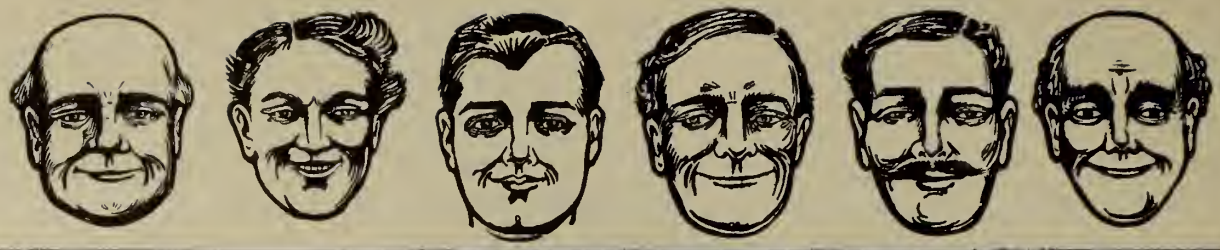
The copper disc used in the mercury bath is platinum-plated and enamelled. This preserves the copper from the action of the mercury. Jewels are used at both ends of the spindle. This instrument is the product of years of experience and should meet with popular favor in central station work and is made in sizes from 3 amperes to 1,200 amperes. This meter is also made in the switchboard type and is fitted with the plain reading "Cyclometer Dial."

The direct reading "Cyclometer Dial" is one of the features of the D.C. Ferranti meter. Any customer can easily read it and keep check on the electric companies. This construction of dial also saves the time of the meter reader and a staff calculator is not required. It is therefore an important feature of interest to both consumer and company.




Interior View of Ferranti Meter.

Ferranti meters are being marketed in Canada by George C. Royce, 22 Dundas St., West Toronto.



# The Laugh Department

### To Start a Gasoline Engine.

The following solution of the problem is said to have been discovered on the Rideau Lakes, though it is here reprinted from a now defunct western Ontario weekly. The advice may also suit the amateur automobilist: "First light your pipe, then sit down and look at your engine for ten minutes. If by that time it hasn't started then you know there's something the matter. Don't get mad, but turn the wheel once, and it it don't spit give it a new chew. See that your switch and carburetor are all right and then turn the wheel again. If it don't go, crank it fifty times, then if it doesn't start, crank it a hundred times and try to keep your temper. If you can't keep your temper in check, paddle your launch a mile up the river where no one will hear what you say about the engine. After you have cranked it for two hours and it won't start, then turn on the gasoline. You will then be successful."

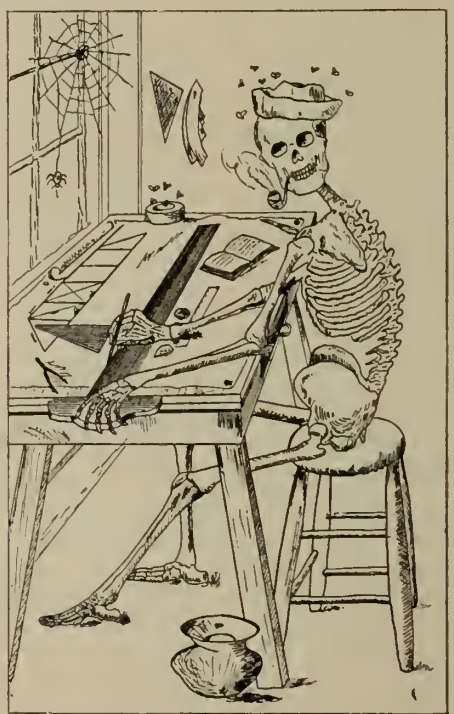
### Rules For Painting the Engine Room Floor.

Be sure your floor is clean. If there should be paint spots on it clean them off with caustic potash, and if there are any large cracks fill with putty. You can buy staining of all kinds (you bet you can—some worse) at hardware stores, and dilute it with turpentine, as it is too thick usually.

If the floor is to be walnut do with a cloth (get a good strong cloth, the dish rag if it hasn't been washed lately) or brush. If you want to make your (here's where the hotel-made editor gets in his home-made receipts) stain, buy a one-pound can of burnt umber, ground in oil; mix a sufficient quantity of this with boiled linseed oil to color it without thickening the oil to notice it much. (If you do notice it much, run the mixture through the oil separator, till you don't notice it.)

Try it on a small piece of wood (or small dog—if the dog wags his left ear the mixture is all right) till you get the color desired, and in this way you can easily determine the quantity of umber to use. (If the tone isn't right then take some home and try it over on your piano.) It should be a rich walnut brown. (Do not be discouraged if it looks chestnutty.) Rub this thoroughly into your floor till the stain ceases to come off. (If it still comes off, add a few drops of mucilage and stick it on again.)

If the coloring is not dark enough when dry, give another coat. (But remember things will look darker when



A Long Wait.

the "old man" comes in.) The floor now being stained, prepare for the next day's waxing. (Use the dumb-bells to limber up.) Mix one gallon of turpentine with one pound of beeswax (or soothing syrup) shaved thin. Soak the wax (you'll feel better if you soak the editor) all night in the turpentine before using, then rub on (all night) with a woollen cloth.

### A Long Wait.

Tired of waiting for pay that was long overdue, a draftsman made the accompanying sketch on a large scale. It was presented to the superintendent who adjusted things satisfactorily, and the draftsman was happy.

### Perpetual Motion at Last.

I submit herewith the drawing of a working model of a perpetual motion machine. I know how other inventors who have worked along this line have been made fun of, and the fear of ridicule has for years kept me from making my invention public. In fact, I invented it while still a small boy, and I think a single glance at the drawing will show how simple both the machine and its inventor are.

The machine consists of a number of

Perpetual Motion?

radial arms, to the end of each of which is attached a weight, the whole revolving on an axis. The machine revolves from right to left. As it turns, the weights attached to the ends of the arms gradually change from 6 to 9 pounds each, the transformation being reversed as the weights begin to rise. This may seem complicated—even absurd—to some; but every great invention has been laughed to scorn by the ignorant and fatuous populace. Besides a single glance at my drawing will show that in spite of what physicists may say, the weights on my machine do act in just that way.

I am not looking for any financial reward. I shall be satisfied if no one throws a brick.—I. N. Ventor in The Technical World.

# Wanted—Miraculous Results

By A. B. LEVER

SOME people expect miracles from every dollar they invest in advertising.

If they buy a block of merchandise, a piece of land, stocks, or bonds, they are quite satisfied if they get in return a fairly good profit.

A miracle is something which they never expect from such investments.

But when it comes to investing in advertising it is a horse of another color.

Results to them are only satisfactory if they get back the original dollar invested as well as the dividends by the first mail.

Advertising does great things. All great modern businesses have been built up on advertising.

But there have been no miracles performed.

Good advertising produces good results.

Sometimes the results are apparent at once.

Sometimes the results, like bread cast upon the waters, are not seen until after many days. But they are sure to be seen eventually.

The character of the results depends a great deal upon the article advertised and the character of the copy.

Business men who expect miracles to be worked by every dollar hey invest in advertising had better not essay to join the army of progressive business men.

They will be disappointed if they do.

As long as a dollar lasts they will at least have the satisfaction of feeling it in their pocket.

Only those should advertise who know that advertising is a straight business investment, productive of good results if judiciously done and properly attended to.

Great results from one brief venture in the advertising field are no more possible than a cultured man from one day's tuition.

Both are the results of gradual and persistent effort, not of miracles.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Electricity and Steam.

Excavation work has been commenced on Cobalt's waterworks system.

A by-law to raise $5,000 for waterworks extension will be voted on by Galt ratepayers on October 16.

The Cranbrook (B.C.) Electric Light Co. have decided to put in a new steam plant at a cost of $30,000 to $50,000.

New Westminster's waterworks intake pipe will be enlarged to supply Coquitlam and Port Moody with water.

Electrical Department, City Hall, Toronto, will shortly call for tenders for pole line supplies, incuding poles, crossarms, pins, braces, etc.

Hamilton has decided, in accordance with the vote of the ratepayers, to enter into a contract with the Hydro-Electric Commission for 1,000 h.p., and will proceed to take the power on June 1, 1910.

The National Carbon Co., of Cleveland, Ohio, have purchased three acres of land at the corner of Davenport Road and the north division of the G.T.R., Toronto. On the site the company will erect a factory for the manufacture of dry batteries.

The Burrard Power Co., Vancouver, has received from the Dominion Government a grant of 25,000 miners' inches of water on Lillooet river. Under the terms of the grant harnessing of the waters of the Lillooet will be commenced at an early date. The power plant is 23 miles from Vancouver.

Tenders will be received for an electrically-driven waterworks pump, with a capacity of 1½ million gallons per day, for the Saraguay Electric & Water Co., and for 6 250 k.w., and 3 500 k.w., 11,000 volts transformers. Mr. Charles Brandeis, consulting engineer, 4 Phillips Place, Montreal.

Tenders will be received until Thursday, October 28, for the construction of a dam and sluiceways across the Montreal river at Latchford. Plans and specifications can be seen at the office of J. G. Sing, district engineer, Confederation Life Building, Toronto, and on application to the Postmaster at Latchford.

At a recent meeting of Coldwater ratepayers it was resolved that the council be asked to have a by-law submitted to the people to decide whether the village will instal a system of fire protection alone, at an approximate cost of $10,000, or a complete waterworks system at an approximate cost of $29,000.

Tenders will be received by the City of Toronto, up till noon of Thursday, October, 28, (changed from October 14), for the following electric motors:—

4, 1,500 h.p. synchronous motors; 2, 1,500 h.p. induction motors; 4, 500 h.p. synchronous motors; 4, 500 h.p. induction motors; 2, 225 h.p. synchronous motors.

With exciters, switchboards, connecting material, etc.

Owen Sound is considering a cheap power proposition. The Georgian Bay Power Co. has made an offer of power to the corporation. The offer is to sell 1,500 h.p. to the town at $20 per h.p. at Eugenia Falls, or $24 per h.p. delivered at Owen Sound. The company is developing power at Eugenia Falls, and has part of the construction work complete.

Tenders will be received by the City of Toronto, up till noon of Thursday, October 28, (changed from October 14), for the following turbine pumps:—

4, 13½ million gallon pumps, 100 pounds pressure; 2, 5 million gallon pumps, 300 pounds pressure; 2, 10 million gallon pumps, 65 pounds pressure; 2, 10 million gallon pumps, 110 pounds pressure; 2, 6½ million gallon pumps, 90 pounds pressure; 2, 6½ million gallon pumps, 160 pounds pressure; 2, 1½ million gallon pumps, 65 pounds pressure; 2, 1½ million gallon pumps, 110 pounds pressure.

With valves, piping, bed-plates, couplings, etc.

The Montreal light, Heat & Power Co. has announced that it will engage in the ice business, obtaining water from artesian wells and freezing it by electric power into blocks of any desired shape and size, so as to avoid cutting. This is an example which might with advantage be followed by many a smaller plant. Every lighting plant must be capable of carrying a certain maximum load at the time of night when most lights are in use, but for at least 18 hours out of the 24 the load is from half as much in large cities to almost nothing in small country places, where there is little industrial use of electrical power, so that during the greater part of the day much of the capital invested is earning no dividends. The surplus power might just as well be used in making ice and providing another source of revenue, particularly as the time when the "peak" load is of shortest duration coincides naturally with that of the largest consumption of ice.

### Siemens Bros.' Canadian Agency.

The Siemens Bros. Dynamo Works, London and Stafford, has opened up a Canadian office in the Canadian Birkbeck Bldg., Toronto. This will be the head office for Canada in charge of A. S. Herbert, and it is proposed to open up branch offices in Montreal and Winnipeg. The Siemens Bros. Dynamo Works represent the Siemens companies, which include Siemens Bros. & Co., London, Eng., and the German companies. Electrical equipment of every description will be imported from the English works. Large electrical instalations have been made in every country on the globe, including Mexico, Australia, Africa, Newfoundland, Canada, etc. One of the specialties of the company is long-distance, high tension transmission lines.

### Canadian Tungsten Lamp Co.

The Canadian Tungsten Lamp Co. has been incorporated to operate the Ontario Lantern & Lamp Co., of Hamilton. The new company is capitalized at $300,000, and is composed of Hamilton men, with the exception of John Kremenezky, Vienna, Austria. The company's plant on Cannon Streat East, Hamilton, has been enlarged to manufacture Tungsten lamps.

The officers of the new company are:—W. H. Ginder, president and managing director; F. W. Gates, vice-president and P. D. Crerar, K.C., secretary.

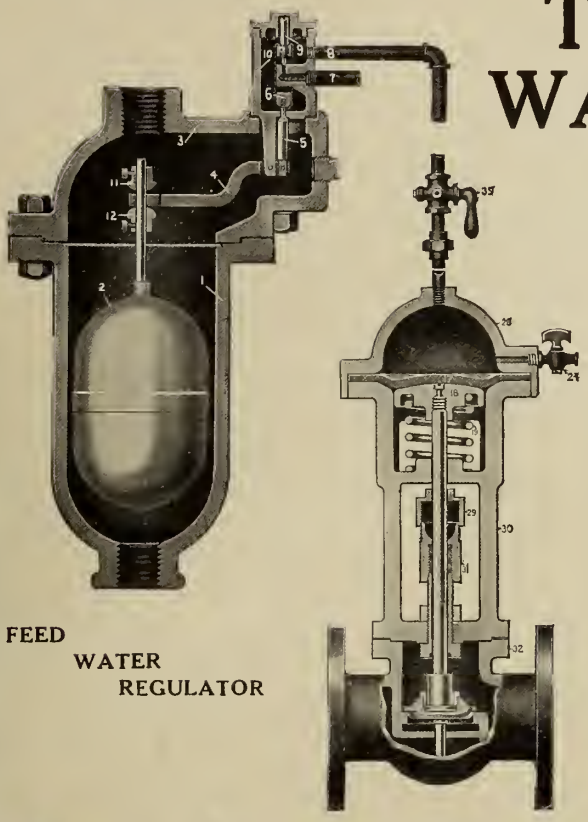
The company has secured the patent rights of Dr. Hans Knzel, Baden, Austria, patentee of the "Kolloid-Wolfram" Tungsten or metallic filament lamp. The machinery for the manufacture of these lamps comes from Johan Kremenezky, Vienna.

### New Canadian Agency.

Chapman & Walker have opened up offices at the corner of Victoria and Lombard Streets, Toronto, as contracting engineers. They represent some of the largest English companies including Crossley; Dick, Kerr; Henley; Nalder & Thompson, and "Z" Tungsten Lamp Co.

The Crossley Co. are manufacturers of the well-known Crossley gas engines, several instalations having been made in Canada. Among these are instalations at James Smart, Brockville;

# The LIBERTY FEED WATER REGULATOR



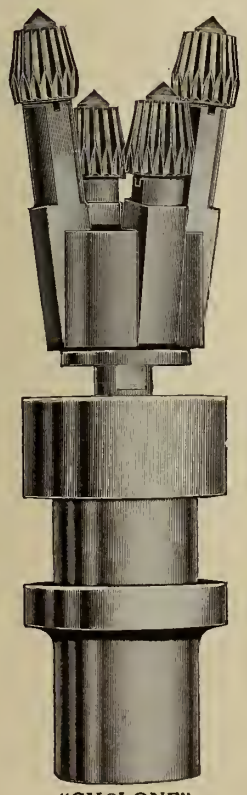
FEED WATER REGULATOR

never grows tired or sleepy, it is always on the job. Maintains the water in the boiler within one-half inch. It has fewer working parts than any other similar device, there being only three moving parts in the LIBERTY REGULATOR. Its simplicity insures its success. Made of the very best material and by the most skilled workmen.

Place a trial order and prove the truth of our statement.

# The TWIN STRAINER

for removing solid matter from your feed line, or from any other liquid, will save you many times its cost in preventing shut-downs. They are an absolutely perfect device for condenser and suction lines and installations, as they enable a steady, high vacuum to be maintained on account of the ease and rapidity with which they can be cleaned.



"CYCLONE"

# The "CYCLONE" TUBE CLEANER

is the Peer of all other tube-cleaning devices for removing scale from water tube boilers. If you have tried other Cleaners, which have proven unsatisfactory, let us send you a "CYCLONE" and you will be surprised to see how efficiently it can do the work in less time and in a better manner than it can be done by any other machine. Do not wait until you are ready to clean your boilers but order one to-day.

TWIN STRAINER

The "CYCLONE" CLEANER is operated by either air or steam. Sixty pounds pressure being ample to operate it successfully.

Send for catalog which tells you all about our FABER BLOW OFF VALVES; OIL PURIFIERS, for both hand and system use; Steam, Oil, Air or Ammonia SEPARATORS and TURBINE CLEANERS of all types.

NOW IS THE TIME TO WRITE BEFORE YOU FORGET ABOUT IT.

## The Liberty Manufacturing Company

6902 Susquehanna Street - - - - - PITTSBURG, PA

Winnipeg municipal plant and a large plant in Cobalt.

Dick, Kerr are one of the largest British exporters of electrical machinery. They make a specialty of A. C. machinery. They have supplied a number of plants in South America. Among the Canadian instalations is a 5,000 k.w. generator for Vancouver.

Nalder & Thompson are manufacturers of ammeters, wattmeters for switchboards. Henleys are manufacturers of power and telephone cables.

---

### TO FIGURE THE SAVINGS MADE BY TUNGSTEN LAMP.

The following is a short concise way to figure the saving that may be effected by using tungsten lamps:—

The new lamp with the new inside metallic filament, which is so rapidly finding a large sale, can perhaps be best described by a direct comparison, that is, one 16 c.p. Tungsten lamp against one one 16 c.p. carbon old or present style lamp.

In the first place assume the life of same to be equal, and each to last or burn, for 1,000 hrs. Not to go into a long definition of a watt, which can be assumed to represent amount, or unit of electricity used in one hour's time, these figures give a comparison of the two lamps.

**1 16 c.p. Tungsten Lamp.**

In one hour consumes 18 watts.
In 1,000 hours consumes 18 x 1,000 or 18,000 w.
1 killowatt=1,000 watts.
Therefore in 1,000 hours Tungsten lamp consumes

$$\frac{18{,}000}{1{,}000} \text{ or } 18 \text{ k.w.}$$

Assuming cost at 10c per k.w. hour.
We have the Tungsten lamp costing us 18 x 10 cents=$1.80.

**1 16 c.p. Present Style Carbon Lamp.**

In one hour consumes 57 w. (approx.)
In 1,000 hours consumes 57 x 1,000 or 57,000 w.
1 killowatt=1,000 wats.
Therefore in 1,000 hours carbon lamp consumes

$$\frac{57{,}000}{1{,}000} \text{ or } 57 \text{ k.w.}$$

Assuming cost at 10c per k.w. hour
We have the carbon lamp, costing us 57 x 10c or $5.70.

Saving of the Tungsten lamp over and above the carbon lamp at the end of 1,000 hours, equal $5.70—$1.80 or $3.90.

From these figures it can be readily seen how economical the Tungsten lamp really is, and why it should be really seriously considered by every user of electricity.

From these figures the Tungsten lamp could be replaced three times and still there would be a saving in favor of the Tungsten lamp, as the carbon lamp at the end of that time would probably consume nearer 60 watts for the 16 c.p. of light, which it should give.

As a further illustration, take the 25 c.p. lamp, a style of Tungsten lamp—which is meeting with great favor. One 25 c.p. Tungsten will give half as much light again as the ordinary 16 c.p. Tungsten, and will only consume one half the number of watts, which means that by its use you get half as much light again as the ordinary lamp and the light bill will be exactly cut in two.

These figures, etc., taken from report of Sterling Electric Supply Co., Ltd., Toronto, Ont., importers of the "Just" Tungsten lamp, which is manufactured in sizes from 16 to 400 c.p.

---

# Power Supply Markets

---

### MONTREAL.

The proximity of colder weather is having the effect of turning attention to heating systems and the specialties supplementary to steam heating are in active demand. The most active are steam traps, temperature regulators, etc., and inquiries and orders for these are coming in very satisfactorily. As in nearly all other lines a reason for increased confidence is found in the good reports from the west of bumper crops successfully harvested. A good deal of western paper is held down here in the east and this is beginning to be well taken up already and the bearing this fact has on business activity is obvious. All the dealers down here report an exceedingly good month for September with prospects of a better one in October.

Dealers in large prime movers, steam and gas, report a satisfactory steadiness in inquiries and orders placed. The Canadian Westinghouse Company have closed with the Halifax hospital for two 100 k.w. generators. These will be direct connected to two 150 h.p. Robb-Armstrong vertical compound engines 12" and 20" x 8 running 450 r.p.m. The new Jacobs building on St. Catherine Street will be equipped with three 150 h.p. 72" x 18'—0" return tubular Robb boilers the order for which was recently placed.

In electrical supplies reports are similar, one dealer on whom we called doing twice as much business in September as in August. Travelers report that orders are far easier to get than two or three months ago. In this line this is the logical result of the betterment of trade in large electrical equipment such as transformers, generators, motors, etc. Some very large orders have been placed for electrical equipment during September in Montreal and the east, honors being shared by the Allis—Chalmers-Bullock Co., and the Westinghouse eastern office. Laurie & Lamb have about completed the installation of the two high speed Belliss and Morcum units in the new power house at McGill University. This plant when finished will be one of the most complete generating stations in the Dominion.

LEATHER BELTING—Hides are higher at the present time than they have been in the last 35 years. It is claimed that one of the reasons for this is that people are not eating as much meat as formerly and that there is a decline in the cattle raising industry. Another reason claimed is that there is more money at present in dairy products and this is detracting from cattle raising. Whether these are responsible or not the fact remains that there has been a raise of four cents per pound (from 12c. to 16c.) since last May. However, the price of leather belting remains stationary in Canada, although at the meeting of the National Association of Belting Manufacturers held in New York on September 16th the prices on the other side of the line were advanced 10 p.c. That the price has not been raised here is due to the fact that some makers have held to the old prices at a loss, simply to get business. Now that business is becoming more easy to obtain a general advance in leather belting may be expected at any moment if the quality of the goods is to be maintained. There is an old saying in the trade that "when hides go up, leather comes down" and in the case of leather belting this is almost true at this time. Boot and shoe leather however has advanced with the hides. Lace leather has also gone up proportionately. The demand for this and leather belting is good, and improving. The orders are of average size but the bulk helps. Large buyers have about contracted for their season's needs, while buying for current needs continues without any signs of a let up.

LUBRICATING OILS—Reports of this line of power plant supplies are decidedly better and show an improvement to date (in some quarters) over the banner year of 1907. We quote only one change in price from last month, namely engine greases are slightly lower. The list is as follows:—High grade cylinder oils (imp. gal.) 60c. to 80c.; engine oils: 30c. to 60c.; machine and dynamo oils, 30c. to 45c.; shafting oils 25c. to 40c.; engine greases (per lb.) 6 to 12c.

GASOLENE—The approach of the close of navigation is stimulating the market in this line for this reason:—Large buyers are rushing their late orders in so as to take advantage of cheaper freight rates by water and dealers report a very busy month with lots of orders on hand for later shipments. The price however is as last month, i.e., 18½c. per imp. gal. or 15½c. in drums with cases $2.60, f.o b. Montreal.

BOILER TUBES—There is nothing startling in the situation as regards boiler tubes. The demand is fair but not as good as conditions a month ago seemed to indicate. Orders from regular customers with here and there an occasional outside order go to make up a fairly good tonnage. Other districts must be getting plenty of orders though, as the mills are chary about promising deliveries. One thing which it is pleasing to note is that the tendency with some dealers which appeared last summer to cut prices seems to have died a natural death and prices are steady and firm throughout the list in this line. Steel plates are enjoying considerable activity at present, orders being very plentiful and some are of considerable size.

Prices for boiler tubes (stock) are:—2-in. tubes (per 100 feet), $8.50 to $8.80; 2½-in., 10.25 to $10.80; 3-inch., $11.75 to $12.35; 3½-in., $15 to $15.75; 4-in., $18.50 to $19.50.

MECHANICAL RUBBER GOODS—The price of crude rubber still continues to keep makers and dealers in mechanical rubber goods guessing. To-day (Oct. 9th) it is quoted from $2.15 to $2.17 with expectations of going as high as $2.30. The price quoted is a rise of over 50 cents from last month's report and there is a question as to the real cause of this. It looks very much as though extensive speculation is going on and if that is the case some one will have their fingers badly burned when the new crop, just about due, comes in. There have been attempted three big "coups" in the Para rubber market during the last twenty-five years, each one ending disastrously to the speculators and with corresponding profits to those in a position to supply the demand. Para rubber is, of

course, the basis of the rubber trade but cultivated rubber is making such headway that conditions will soon be such that even without the Amazon supply manufacturers could get along without much difficulty. Para prices will drop as this cultvated rubber supply increases. However, the high level of prices may reasonably be expected to continue at least until raw material has been secured for such orders as are in sight and the prospective demand for new goods has been more accurately determined. Prices have not yet been advanced in the finished product as manufacturers are in hope that the next crop will alleviate the difficulty of high prices in the crude material.

## TORONTO.

The business in steam specialties is increasing and some good orders have been received. Boilers are also in demand. The manufacturers are endeavoring to secure uniform regulations in all the provinces of the Dominion and the securing of this should greatly stimulate trade. It will take some time however to interview the provincial authorities and interest them in the scheme. Uniform legislation would be a boon to both manufacturers of boilers and consumers.

A great many small boilers (return tubular) are being taken into the mining districts of Northern Ontario. When a railway line is opened to Gowganda there will be a number more shipped in to that country.

Trade generally is on the upward march as the Dominion returns show. The customs revenue for September shows an increase of thirty-five per cent. over the same month last year and the total revenue for the past six months shows an increase of over 6½ millions over the same period last year.

A number of new electrical supply agencies have been opened up in Toronto recently and are already getting a share of the trade. These include the Stirling Electric Co. handling the "Just" tungsten lamp; Chapman & Walker, handling the "Z" tungsten lamp and Dick, Kerr electrical machinery besides Crossby gas engines and producers. Another agency is Siemens Bros., manufacturers of all kinds of electrical machinery. The longer established companies also report trade good and several large orders have been booked. It is noticeable that quantities of British machinery are being imported as well as Austrian and Sweedish machinery. In Hamilton is the Canadian Tungsten Lamp Co. and machinery from Bavaria is being installed for the manufacture of Kolloid-Wolfram Tungsten lamps.

MECHANICAL RUBBER GOODS — There is a firm tone to crude rubber noted in the spot market despite reports of easier tone abroad. Such business as was put through was on the basis of full prices, islands fine being quoted as high as $2.03 and up, river fine at $2.14. Spot stocks are light and closely held, the buying being for absolute needs of manufacturers. While there has been much talk of light receipts the total for Para during the month of September is given as 2,295 tons, only five less than in 1908. The receipts at Para are being purchased about as fast they come down the river.

In view of the high price prevailing it is expected that all mechanical goods, including fire hose, packing, belting, etc., will suffer a rise in price. Unless greater shipments are imported or the speculators are forced to give in, a rise in price of manufactured products, is inevitable.

BOILER TUBES—Lap welded steel per 100 ft., 2-in, $8.50 to $8.75; 2¼-inch, $10 to $10.75; 2½-inch, $10.75; 3-inch, $12; 3½-inch, $15, and 4-inch, $18.50 to $19.

BELTING—The prices have advanced in New York as was expected. As an example of the rise in leather farmers are now receiving $10 for a sixty pound hide where formerly they received $3. Harness and collar leathers have reached unusual high levels, and old stocks being sold, the harness-maker has now to pay in the neighborhood of forty cents a pound for leather, a full twenty per cent. more than a year ago, with no prospect of relief in sight. The import duty on hides shipped into United States is now five per cent. and U. S. firms are placing orders with Canadian tanners for hides. This extra trade is quickly bringing the market to a condition of scarcity, and although advances in prices are only small as yet, it is probable that the tanners will use this opportunity to put their business on a more profitable basis, and the ultimate advance will doubtless be about twenty per cent. The depletion of the available supply of Canadian green hides by American tanners continues, and whereas it was at first thought that the removal of the duty would only result in a temporary trading, the conclusion is now being forced upon Canadian tanners that the United States has real need of many more hides than their own cattle trade produces, and for some years to come it will be a keen competition to see who will get the hides. Naturally the leather belting trade will be affected, and advances in prices on Canadian belting would not be unexpected. Business is good.

LEAD WOOL—Price stationary at $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35; American, $27.50 to $35 per 1,000.

## CATALOGUES.

STEAM SPECIALTIES—A catalogue of much interest, giving descriptions, illustrations and prices has been issued by the Sims Co., for whom the Ideal Steam Separator & Supply Co., 75 Adelaide East, Toronto, are the agents. The catalogue known as "H" is a valuable one not only on account of the information but also on account of the price lists. The specialties include boiler cleaners, steam separators, oil extractors, exhaust heads, low water alarms, oil filters, compound feeders, water softeners and heaters. Every engineer should have one of these combined catalogues and price lists in his possession. Mention The Power House in your request.


**ELECTRIC BARGAINS**

**We have some GOOD, PRACTICALLY NEW, MOTORS GOING AT A SACRIFICE**

We manufacture alternating and direct current motors in all sizes also sell Century single phase motors in all their sizes. Repairs promptly and cheaply performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Toronto, Ont.

**Chief Draftsman AND ENGINEER**

will **personally—practically** instruct a few ambitious, deserving, bright men on practical, actual, up-to-date **Drafting Room Work** at home, prepare and qualify them as first-class **experienced Draftsmen** and **Designers** for a salary **paying $100 to $150 per month.**

Instructions until competent, and **placed in position free.** Also complete high grade drawing outfit, with German Silver set of **instruments worth $13.85 free this month. Don't** answer this unless you are ambitiously seeking success and willing to work for results.

**Address CHIEF DRAFTSMAN, Div. 23**
**ENGINEERS EQUIPMENT CO. (INC.) CHICAGO, ILL.**

**Pumping Machinery**

We supply or erect complete plants for general

**"Water Supply" or "Fire Service"**

**Pumps, Tanks and Supplies** always in stock.

**R. H. BUCHANAN & CO.**
234 Craig St. West . . . . MONTREAL

*Eclipsed by None* **WALKER'S ELECTRIC BOILER COMPOUND**

**CYLINDER OILS:** Regal Valve, Red Star, Monarch, Low Pressure. **ENGINE AND MACHINE OILS:** Superior, Electric, Gas, Ideal Press, Vulcan Machine, Heavy Red. Flue Cleaners, Lace Leather, Graphite, Gauge Glasses, Compression Greases and all Engine Supplies. **SPECIALTY DEPARTMENT:** Waxine Floor Oil, Tri Sodium Phosphate. **FLEXIBLE RUBBER ROOF PAINT.** *Prices on Application. Correspondence Invited*

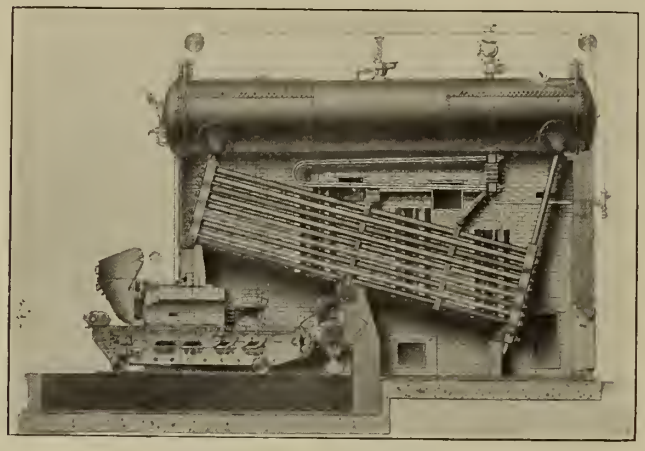
**THE ELECTRIC BOILER COMPOUND CO., Limited**
GUELPH :: ONTARIO

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST EOCNOMY, SAFETY, DURABILITY OVER 7,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Boiler, Superheater, and Mechanical Stoker

ALSO

Steam Superheaters
Mechanical Stokers
Coal-Handling Machinery
Piping, Feed Water Heaters
Water Softeners and Purifiers
and ELECTRIC RANGES

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING

# POWER EQUIPMENT

### Gas and Gasoline Engines

1 new 25-32 h.p. Petrie horizontal gas engine.
1 refitted 25 h.p. vertical marine gasoline engine.
2 new 15-18 h.p. Petrie horizontal gas engines.
1 refitted 14-16 h.p. Ideal horizontal gasoline engine
1 new 13-16 h.p. Petrie horizontal gas engine.
1 refitted 14 h.p. Petrie horizontal gas engine.
1 refitted 12-14 h.p. Toronto horiz. gasoline engine
1 refitted 10 h.p. Labatt vertical gasoline engine.
1 new 8 h.p. Petrie horizontal portable gasoline engine with wood yard saw.
2 refitted 8 h.p. Ideal horizontal gasoline engines.
1 refitted 8 h.p. Haggas horizontal gasoline engine
1 new 6 h.p. Stover horizontal gasoline engine.
1 new 6 h.p. Defiance marine gasoline engine.
1 new 6 h.p. Simplex horizontal gasoline engine.
1 refitted 6 h.p. Olin horizontal gasoline engine
1 refitted 6 h.p. Imperial vertical gasoline engine.
1 new 4-5 h.p. Petrie horizontal gasoline engine.
1 refitted 4-5 h.p. Otto horizontal gas engine.
1 new 3½ h.p. Triton marine gasoline engine.
2 refitted 3 h.p. Imperial vertical gasoline engines
1 refitted 3 h.p. Ideal horizontal gasoline engine.
1 new 1½-2 h.p. Acme marine gasoline engine.
1 new 1½ h.p. Typo horizontal gasoline pumping engine.
1 refitted 1½ h.p. Northey vertical gasoline engine.

### Electric Motors

1 refitted 50 h.p. Jones & Moore, 220 volts, alternating current motor.
1 refitted 15 h.p. Jones & Moore, 250 volts, direct current motor.
1 refitted new 12 h.p. Consolidated, 250 volts, direct current motor.
1 nearly new 8 h.p. Consolidated, 250 volts, direct current motor.
1 new 12 h.p. Kay, 220 volts, direct current motor
1 new 8 h.p. Kay, 250 volts, direct current motor.
1 refitted 7 h.p. Jones & Moore, 250 volts, direct current motor.
2 new 5 h.p. Kay, 220 volts, direct current motors.
1 new 2½ h.p. Kay, 2 phase, alternating current motor.
1 refitted 2 h.p. Jones & Moore, 500 volts, direct current motor.
1 refitted 2 h.p. Jones & Moore, 250 volts, direct current motor.
1 refitted 2 h.p. Jones & Moore, 110 volts, direct current motor.
1 new 1 h.p. Kay, 220 volts, direct current motor with air pump.
1 new 1 h.p. Kay, 220 volts, direct current motor.

### Generators

2 refitted 100 k.w. Canadian General, direct current generators.
1 nearly new 100 k.w. Canadian General, alternating current generator.
1 refitted 60 k.w. Jones & Moore, direct current generator.

### Engines and Boilers

1 10"x11" Abell portable engine and boiler.
1 9"x12" Nagle portable engine and boiler.
1 8"x12" semiportable engine and boiler.
1 8"x10" White portable engine and boiler.
1 7"x10" Champion portable engine and boiler.
1 7"x10" Cornell portable engine and boiler.
1 7"x10" Waterloo portable engine and boiler.
2 5½"x7" vertical engines and boilers.
1 refitted 14 h.p. Cornell traction engine.
1 refitted 10 h.p. Westinghouse traction engine.
1 refitted 30"x10' semiportable return tube boiler.
1 refitted 48"x20' semiportable fire box boiler.
1 refitted 44"x18' semiportable fire box boiler.
1 refitted 36"x13'10" semiportable fire box boiler
2 new 36"x13' semiportable fire box boilers.
1 refitted 36"x12'10" semiportable fire box boiler.
1 refitted 36"x13' semiportable fire box boiler.
1 new 30"x12' semiportable fire box boiler.

*OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST*

# H. W. PETRIE, Ltd., Toronto, Montreal, Vancouver

The advertiser would like to know where you saw his advertisement—tell him.

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

R. H. Buchbnan & Co., Montreal
Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

R. H. Buchanan & Co., Montreal
Plomo Specialty Mfg Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. D. McArthur, Brockville
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

W. H. Adams, 102 Nazareth St., Montreal, Que.
Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Hygienic Laboratories, Toronto
Nichols Chemical Co., Montreal
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto
Michigan Lubricator Co., Detroit
Morehead Mfg. Co., Detroit, Mich.

## Boiler Feed Pumps.

R. H. Buchanan & Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Michigan Lubricator Co., Detroit
Wm. B. Pierce Co., Buffalo

## Boilers.

Babcock & Wilcox, Montreal
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Boosters.

Geo. C. Royce, West Toronto

## Canners' Machinery.

J. C. Wilson & Co., Glenora, Ont.

## Cars, Transfer.

Corbet Foundry and Machine Co., Owen Sound

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Canada Chemical Mfg. Co., London

## Circuit-Breakers.

Geo. C. Royce, West Toronto

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Walter J. Francis, Montreal.
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward R. Merrill, Toronto.
Messrs. Mitchell, Toronto
Moore & Scollan, Toronto
John B. McRae, Ottawa
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto

## Contractors, Structural Steel

Corbet Foundry and Machine Co., Owen Sound

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenors, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montresl

## Crank Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo, N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Mechanical & Elec. Lab., Buffalo
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Electrical Accessories.

Chapman & Walker, Toronto

## Electrical Machinery.

Chapman & Walker, Toronto

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Chapman & Walker, Toronto
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

ercules Float Works, Springfield, Mass.

## Flumes, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Fuses.

Geo. C. Royce, West Toronto

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peterboro Lubricator Mfg. Co., Peterboro

**Hangers.**
Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

**Heaters.**
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

**Indicators, .Electric—All Types.**
Geo. C. Royce, West Toronto

**Indicators, Steam Engine.**
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

**Injectors.**
Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

**Lamps, Incandescent,**
Chapman & Walker, Toronto
Packard Electric Co., St. Catharines

**Lead Wool.**
John Garde & Co., Toronto.

**Lubricators, Force Feed.**
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

**Maple Cogs.**
J. C. Wilson & Co., Glenora, Ont.

**Mechanical Stokers.**
Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

**Meters, Water and Electric.**
Peiler & MacKenzie, Montreal
Geo. C. Roper, West Toronto

**Mill Machinery.**
Allis-Chalmers Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg, Co., Lindsay, Ont
Waterous Engine Works Co.. Brantford
J. C. Wilson & Co., Glenora, Ont.

**Mining Machinery.**
Allis-Chalmers-Bullock, Ltd., Montreal

**Motors.**
Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

**Motor Starters.**
Geo. C. Royce, West Toronto

**Oil and Waste Saving Machines.**
The Canadian Oil & Waste Saving Machine Co., Brockville, Ont.

**Oilers, Gang.**
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

**Oil Filters**
Darling Bros., Montreal

**Oil Separators.**
Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

**Oils, Lubricating.**
The "Skaleoff" Co., Montreal, Que.

**Packing, Leather.**
R. H. Buchanan & Co., Montreal
Detroit Leather Specialty Co., Detroit

**Packing, Metallic.**
Rhodes Improved Metallic Packing Co. Montreal

**Panels, Electric**
Hill Electric Switch Co., Montreal

**Perforated Metals.**
Allis-Chalmers-Bullock, Ltd., Montreal

**Pipe Cutting and Threading Machines.**
Curtis & Curtis Co., Bridgeport, Conn.

**Pipe Threading Tools.**
Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

**Piping, Steam,**
Babcock & Wilcox, Montreal

**Planimeters.**
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

**Plate Work.**
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

**Polish, Metal,**
G. W. Hoffman, Indianapolis

**Power Pumps.**
R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

**Power Transmission Machinery.**
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

**Processing Retorts.**
J. C. Wilson & Co., Glenora, Ont.

**Pulleys, Iron.**
J. C. Wilson & Co., Glenora, Ont.

**Pumping Machinery.**
Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Moutreal

**Pump Governors.**
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros , Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

**Pump Strainers.**
Canadian Steam Boiler Equipment Co., Toronto

**Pumps, Air,**
Lunkenheimer Co., Cincinnati, Ohio

**Pumps, Oil.**
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

**Reducing Wheels.**
Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

**Rheostats.**
Geo. C. Royce, West Toronto

**Safes.**
Goldie & McCulloch Co., Galt.

**Safety valves.**
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

**Shafting.**
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,
J. C. Wilson & Co., Glenora, Ont.

**Shaking and Dumping Grate**
Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

**Smoke Consumers.**
Canadian Steam Boiler Equipment Co., Toronto
The "Skaleoff" Co., Montreal, Que.

**Smoke Stacks.**
Babcock & Wilcox, Montreal
Corbet Foundry and Machine Co., Owen Sound

**Special Machinery.**
Electrical Maintenance and Repair Co. Toronto.

**Sprocket Wheels.**
J. C. Wilson & Co., Glenora, Ont.

**Spur Wheels.**
J. C. Wilson & Co., Glenora, Ont.

**Steam Pumps.**
R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

**Steam Separator.**
Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto

**Steam Specialties.**
Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Standard Engineering Co., Toronto.

**Steam Traps.**
Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Morehead Mfg. Co., Detroit, Mich.
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

**Stokers.**
Eric Foundry Co., Erie, Pa.

**Switches, Electric**
Hill Electric Switch Co., Montreal

**Superheaters, Steam,**
Babcock & Wilcox, Montreal

**Switchboards, Light and Power.**
Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co , Montreal
Geo. C. Royce, West Toronto

**Switches.**
Geo. C. Royce, West Toronto

**Tanks, Blow-off**
Darling Bros., Montreal

**Tanks, Oil.**
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

**Tanks, Steel.**
Corbet Foundry and Machine Co., Owen Sound

**Tests and Inspections.**
Bain & Mitchell, Montreal

**Transformers.**
Allis-Chalmers-Bullock, Ltd., Montreal
Geo. C. Royce, West Toronto

**Transmission Machinery.**
Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

**Trucks, Dry Kiln.**
Corbet Foundry and Machin Co., Owen Sound, Ont.

**Trucks, Factory.**
Corbet Foundry and Machine Co., Owen Sound

**Tubes, Boiler,**
Babcock & Wilcox, Montreal

**Turbine Water Wheels.**
Allis-Chalmers-Bullock, Ltd , Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

**Turbines, Steam.**
Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

**Unions**
Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit

**Vacuum Drying and Impregnating Apparatus.**
J. P. Devine Co., Buffalo, N.Y.

**Vacuum Governors.**
Canadian Steam Boiler Equip ent Co. Toronto

**Vacuum Pans.**
J. P. Devine Co., Buffalo, N Y.

**Vacuum Pumps.**
Canadian Steam Boiler Equipment Co., Toronto
J. P. Devine Co., Buffalo, N.Y.

**Vacuum Regulating Valves.**
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

**Vacuum Traps.**
Morehead Mfg. Co., Detroit, Mich.

**Valve Reseating Machines**
Darling Bros., Montreal

**Valves.**
Canadian Steam Boiler Equipment Co., Toronto
Jenkins Bros., Montreal
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Standard Engineering Co., Toronto.

**Vaults & Vault Doors.**
Goldie & McCulloch Co., Galt.

**Water Purifiers.**
Babcock & Wilcox, Montreal

**Water Softeners.**
Babcock & Wilcox, Montreal

**Watt Meters.**
Gas & Electric Power Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


Allis-Chalmers-Bullock ..... inside front cover

Babcock & Wilcox ..... 64
Bain & Mitchell ..... 69
Beaubien, De Gaspe ..... 69
Brownell Co ..... 3
Buchanan, R. H., & Co ..... 63
Buffalo Mechanical and Elec. Lab ..... 50
Butterworth Foundry Co ..... 5

Canada Foundry Co ..... 11
Canada Gas Power & Fuel Co ..... 19
Canada Metal Co ..... 5
Canadian Assn. Stationary Engineers ..... 18
Canadian Oil and Waste Saving Machine Co ..... 23
Canadian Steam Boiler Equipment Co ..... 5
Chapman & Walker, Limited ..... 1, 72
Cling-Surface Co ..... 15
Corbet Foundry & Machine Co ..... 67
Curtis & Curtis ..... 21

Darling Bros ..... 21
Dart Union Co ..... 17
Death & Watson ..... 58
Detroit Leather Specialty Co ..... 16
Devine, J. P., Co ..... 70
Diamond rate Bar Co ..... 4
Dietrich, W. N ..... 69
Dominion Belting Co ..... 20

Electrical Maintenance & Repair Co ..... inside back cover
Electric Boiler Compound Co ..... 63
Engineers' Equipment Co ..... 63
Erie Foundry Co ..... 13

Farmer, John T ..... 69
Fetherstonhaugh ..... 69
Francis, Walter J ..... 69

Galt & Smith ..... 69
Gardo, John, & Co ..... 67
Goldie & McCulloch Co ..... 24
Goodhue, J. L., & Co ..... 9
Goold, Shapley & Muir ..... 19

Hawkins, W. T., & Co ..... 9
Hercules Float Works ..... 69
Hill Electric Switch Co ..... 67
Hoffman, G. W ..... 67
Hoffman, Jules G ..... 14
Hygienic Laboratories ..... 15

Ideal Steam Separator & Supply Co ..... 17

Jenckes Machine Co ..... 3
Jenkins Bros ..... 6
Johnson, F. M. G ..... 69
Jones & Moore Electric Co ..... 63
Jones Underfeed Stoker Co ..... 18

Kerr Engine Co ..... 13
Kilmer, Pullen & Burnham ..... Inside back cover

Leonard, E., & Sons ..... 3
Liberty Mfg. Co ..... 61
Lunkenheimer Co ..... 13

McArthur, J. D ..... 9
McGhie, W. C ..... 67
McLaren, D. K., Ltd ..... 8
McLeod & Henry Co ..... 21
McRae, J. B ..... 69

Merrill, Edward B ..... 69
Michigan Lubricator Co ..... 16
Mitchell, C. H. & P. H ..... 69
Moore & Scollan ..... 69
Morehead Mfg. Co ..... 11
Morrison Brass Mfg. Co., Ltd., Jas .. outside back cover

Nichols Chemical Co ..... 7
Northern Electric and Mfg. Co ..... 70

Packard Electric Co., Ltd ..... 71
Peiler & MacKenzie ..... 12
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 64
Pierce, Wm. B ..... 7
Plomo Specialty Mfg. Co ..... 9
Polson Iron Works ..... 2

Riblet Heater Co ..... 10
Robb Engineering Co ..... 23
Robertson, J. M ..... 69
Russel & Gifford ..... 7
Royce, G. C ..... 71

Sadler & Haworth ..... 23
Sammett, M. A ..... 69
Shanly, J. M ..... 66
Sight Feed Oil Pump Co ..... 19
Skaleoff Co ..... 14
Snowdon, C. C ..... 14
Sterling Electric Supply Co ..... 72

Technical Books ..... 22
Turbo-Blower Co ..... 20

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 18
Wilson, J. C., & Co ..... 65

## MISCELLANEOUS.

(Continued Advts.)

YOUR CHEQUE CAN'T BE RAISED to any amount above that which you intend it to cover if you use the PROTECTOGRAPH. This device stamps a line such as "Not over ten dollars, $10," with acid proof, indelible ink, which penetrates right through the fibre of the paper. This device is being used by 90% of the Banks of Canada and the United States, as well as the treasuries of both countries. Write for full particulars and price. W. E. Parker & Co., Sole Canadian Agents, 37 Yonge Arcade, Toronto, Ontario.

JUST NOW we are holding a special sale of second-hand typewriters. All makes are represented—Underwood, Remingtons, Olivers, Empires, Smith Premiers, etc. They have been carefully rebuilt and are in good workable, wearable condition. The Monarch Typewriter Company, Limited, 98 King Street West, Toronto, Ont. (tf)

PEERLESS CARBON PAPERS and TYPEWRITER RIBBONS are unequalled in writing, manifolding and wearing qualities. Our "Klear Kopy" Carbon was awarded a contract over 43 competing lines by one of the world's largest governments. All up-to-date dealers in stationery, typewriters and office supplies handle our goods. Ask them or write us direct for prices and samples. Peerless Carbon & Ribbon Manufacturing Co., Toronto, Canada.

WANTED—A splendid opportunity for dealers to handle the best combination Duplicating, Addressing and Office Printing Machine on the market. Exclusive territory. Send name and address, giving occupation and references, to the Canadian Writerpress Company, Ltd., 33 John St., Hamilton, Ont. (tf)

SIR GILBERT PARKER is to the fore again with his latest book entitled "Northern Lights." It pictures the life of that portion of our country upon which all eyes are now turned. The stories portray conditions in the Great West before and after the effects of modern civilization, and treat the subject with a master-hand. For sale at all bookstores. Cloth bound illustrated, $1.50. The Copp, Clark Co., Ltd., Publishers, Toronto. (tf)

CASH AND PACKAGE CARRIERS, 20 years' experience inventing and building modern store service appliances. Our guarantee.—We will install a system of our Carriers in your store; you use them ten days, and if you do not find that they give you better and quicker service than any other Wire Carriers, Pneumatic Tubes, Cable Carriers, or Cash Registers, we will remove them at our expense. Write for catalogue and testimonials from reliable houses using our Carriers. The Gipe Carrier Co., 99 Ontario St., Toronto, Canada. (tf)

TAYLOR-FORBES COMPANY, LIMITED. Head Office, Works and Foundries, Guelph. Largest manufacturers of hardware in Canada. (tf)

SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling, and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

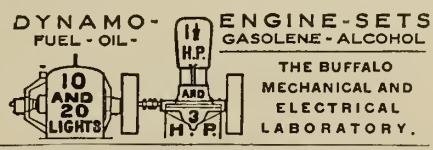
ACCURATE COST KEEPING IS EASY if you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe's time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited. Office and factory, 27 Alice Street, Toronto. (tf)

ELLIOTT-FISHER STANDARD Writing-Adding Machines make toil easier. Elliott-Fisher Limited, 513, No. 83, Craig Street W., Montreal, and 129 Bay Street Toronto.

THOUSANDS OF DOLLARS go astray in the mails every year. YOU should therefore insure against possible loss by sending YOUR remittances by Dominion Express Company money orders and Foreign Drafts. If delayed, lost or stolen, a refund will be promptly arranged or a new money order issued without further charge. The Dominion Express Company also transfers money by telegraph and cable, and buys and sells Foreign money. If you want to send money to any part of the world the Dominion Express Company will be pleased to accommodate you. Hundreds of agencies throughout Canada.

725,000 LIVE MERCHANTS use National Cash Registers. We couldn't sell them unless they saved people money. The National will guard your money too. Write us for proof. National Cash Register Company, 285 Yonge Street, Toronto.

OFFICE FIXTURES, PARTITIONS AND SHOW CASES. Send for illustrated catalogue. Jones Bros. & Co., Limited, 30-32 Adelaide St. W., Toronto, Ont.



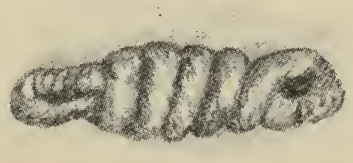

U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD

# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.

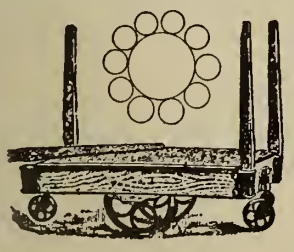
"Just around the corner from Queen and Yonge"

Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND



## Roller Bearing Factory Trucks

The only ones made in Canada

## Dry Kilns Installed

Roller Bearing Dry Kiln Trucks
Roller Bearing Transfer Trucks
Roller Bearing Lumber Trucks

## MUNICIPAL STEEL BRIDGES

Specifications Solicited.

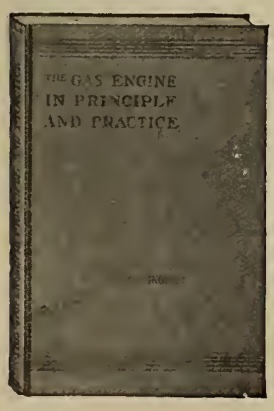
We make any kind of truck to specifications. Heavy duty truck a specialty. Write for prices to

**Corbet Foundry & Machine Co., Owen Sound**

## Notice to Stationary Engineers

Everyone operating a Stationary Steam Plant of 50 h.p. or over in the Province of Ontario must hold a Certificate from this Board. Anyone operating such a plant without a Certificate is liable to the penalties set forth in the Stationary Engineers' Act.

W. C. McGHIE,
Chairman of Board
Parliament Buildings, Toronto.




## The Gas Engine in Principle and Practice

*By A. H. Goldingham*

***Price $1.50, Postpaid***
***195 Pages, 107 Illustrations***

The articles in this book give clearly and concisely the comparison of the two-cycle and four-cycle types of Internal Combustion Engines, with description of the Various Designs, together with notes on Suction and Pressure Type Gas Producers, Crude Oil Vaporizers, etc. It is of great value to EVERYONE interested in GAS ENGINES.

***Technical Book Department***

**The MacLean Publishing Co., Ltd., 10 Front St. East, Toronto**

## Switch Board Parts

### Bulletin 3A—Just Out.

SEND FOR COPY.

**The Hill Electric Switch & Mfg. Co., Ltd.**

1560 St. Lawrence Street - Montreal

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1¼" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### For Sale

FOR SALE CHEAP FOR CASH—One 15 h. p. horizontal engine, second hand, made by F. Lowe & Sons. Ottawa. Apply to Marshall Rothwell, P.O. Box 1, Navan, Ont. (10)

### For Sale

FOR SALE or will grant exclusive right to manufacture on royalty Canadian Patent 115643 a necessary household article simple to make. Arthur Solomon, 211 Winslow Ave. Buffalo, N.Y. (11)

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBONTYPE PORTABLE BOILERS—7' each, 60 h.p.

HEINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five years.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### Electric Lighting

THE town of North Battleford, Saskatchewan, th chief divisional point on the main line of th Canadian Northern Railway is open to grant franchise for electric lighting. Address, J. A. Gregory Mayor.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12 x 12 M'Ewen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumos, second hand. Waterous Eng'ne Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

### For Sale

One Westinghouse Generator, 54 k.w. Direct current, 125 volts, speed 850, complete with switchboard, instruments, etc. Best of order. Will sell reasonable. Mr. Taber, 444 Bathurst St., Toronto. (8)

### For Sale

Two Fitzgibbon Boilers for sale at a bargain. Are now carrying 70 lb pressure. Would make splendid heating boilers. G. C. Mooring, 16 Pearl Street, Toronto. (9)

### For Sale

ONE 5 h.p. Cook vertical gasoline engine, double ignition, complete with tank, skids, and all accessories. A new engine at a bargain for quick sale. Kellogg & Co., 196 King St. West, Toronto.

### For Sale

Electric Motors. One 5 horse-power re-wound this year; also one single horse-power, slightly used; both direct current. Apply Box 93, POWER HOUSE, Toronto. (12)

TENDERS will be received by the City of Toronto, Canada, up till noon of THURSDAY, OCTOBER 28th, for the following Electric Motors and Turbine Pumps. For specifications and form of tender apply to the City Engineer.

ELECTRIC MOTORS

4 1500 H. P. Synchronous Motors.
2—1500 H. P. Induction Motors.
4 500 H. P. Synchronous Motors.
4 500 H. P. Induction Motors.
2 225 H. P. Synchronous Motors.
With Exciters, Switchboards, connecting material, etc.

TURBINE PUMPS

4 13½ million gallon pumps, 100 pounds pressure.
2 5 million gallon pumps, 300 pounds pressure.
2 10 million gallon pumps, 65 pounds pressure.
2—10 million gallon pumps, 110 pounds pressure.
2—6½ million gallon pumps, 90 pounds pressure.
2—6½ million gallon pumps, 160 pounds pressure.
2—1½ million gallon pumps, 65 pounds pressure.
2—1½ million gallon pumps, 110 pounds pressure.
With a Valves, Piping, Bed-Plates, Couplings, etc. (10)


## SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

# PROFESSIONAL DIRECTORY

**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Eleotrical, Hydraulic, Steam, Gas.
Plans, Specificatlons, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737 / East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**W. N. DIETRICH**
ELECTRICAL AND MECHANICAL ENGINEER
16 St. Sacrament Street, Montreal
CONSULTING AND CONTRACTING
Supervision, Specifications, Plans, Tests, Reports, Etc.

HARRY A. MOORE — JOHN J. SCOLLAN
**MOORE & SCOLLAN**
ELECTRICAL AND MECHANICAL ENGINEERS
STEAM, ELECTRIC AND HYDRAULIC POWER
CONSULTATION, REPORTS, ESTIMATES, PLANS, CONSTRUCTION, TESTING, ETC.
OFFICES: GUARANTEE BLDG., 43 KING ST. W.
TELEPHONE MAIN 445 — TORONTO, CAN.

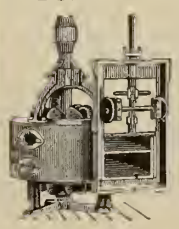
**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 2716

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**EXPERTS**
ON
SMOKE PREVENTION
AND
BOILER ROOM EQUIPMENT
Canadian Representatives:
The TRIUMPH STOKER, Leeds, Eng.
CONSULTING ENGINEERS
Steam Hydraulic Mechanical
**BAIN & MITCHELL,**
Y.M.C.A. Building, MONTREAL

**HERCULES** Seamless Copper **FLOATS**
**Are Absolutely Reliable**

We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request.
**Hercules Float Works**
P.O. Box 396. — Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**

Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest efficiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty

## PERFECT INSULATION

of Electric Coils, Cables, etc., is dependent upon a perfect system of drying and impregnating.

The Emil
PASSBURG SYSTEM
of Vacuum Drying and Impregnating

is the most satisfactory and economical process yet discovered. We manufacture all sizes and types.

Write for our Descriptive Catalogue.

J. P. Devine Company
BUFFALO N. Y.

POWER USERS, ENGINEERS OR CENTRAL STATION MEN wanting the name and address of the manufacturer of any class of power equipment, whether for steam, gas, or electric plants, will be able to obtain same by writing to the Editor of this journal. .:. .:. .:. .:.

# INSTAL "HAWTHORN" INDUCTION MOTORS

## Hawthorn
TRADE MARK
## Motors

AND

## REDUCE OPERATING EXPENSES

***Simplicity of Control***—Can be mounted on the floor, wall or ceiling, or be attached to machine itself.

***Facility of Handling***—Additions to your equipment involve only minimum changing of pulleys, etc.

***Are Operated Individually***—No power wasted when machine is idle.

***Form Compact Unit***—No losses on line shafting or belt transmission.

***Adaptability of Speed***—Any desired speed can be obtained and maintained.

***Overtime Economy***--Motors need only be started for the machines necessary to run.

***Aids to Light and Ventilation***—No superfluous hangers, etc., to block sun's rays and accumulate dust.

***THIRTY YEARS' EXPERIENCE BACK OF HAWTHORN INDUCTION MOTORS. BOOKLET 3107 TELLS THE STORY. SEND FOR COPY.***

## THE NORTHERN ELECTRIC
## AND MANUFACTURING CO. LIMITED

Manufacturers and Suppliers of all apparatus and equipment used in the construction, operation and maintenance of Telephone and Power Plants

| MONTREAL | TORONTO | REGINA | WINNIPEG | VANCOUVER |
|---|---|---|---|---|
| Cor. Notre Dame and Guy Sts. | 60 Front St. W. | | 599 Henry Ave. | 424 Seymour St. |

# Packard TUNGSTEN LAMPS

THE MOST LIGHT FOR
THE LEAST MONEY

## The PACKARD ELECTRIC CO., Limited

Head Office and Works, - - - - - - - - ST. CATHARINES, ONT.
Branch Offices, - - - - - - - - - MONTREAL and WINNIPEG

# FERRANTI METERS

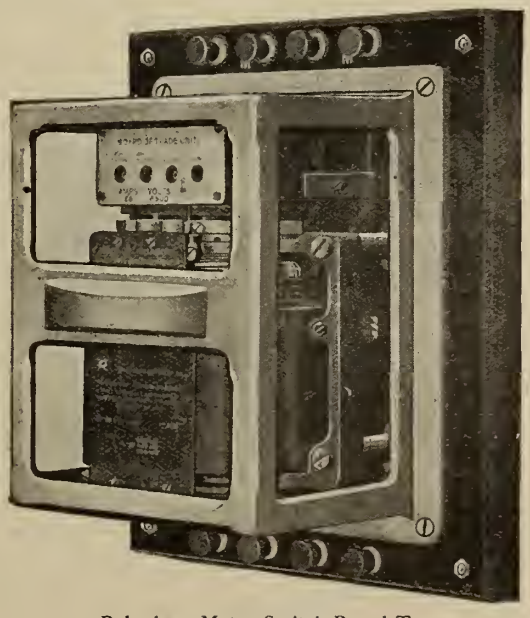
ALL TYPES
For A.C. & D.C. Currents

COMPLETE SWITCH BOARDS AND APPLIANCES

The Ferranti Meter fills all requirements.

Are known and sold the world over.

Remember, we manufacture a full and complete line of Switch Board Instruments, also furnish complete Boards, both High and Low Tension. : : : : :



Polyphase Meter, Switch Board Type

The Ferranti Leads!
"Why"?

It has a low starting current, accurate from 1/20 to 50% overload.

It has a low shunt loss.

No wear nor friction.

Send for our prices before purchasing. They will interest you.

Western Sales Office:
603 UNION BANK BUILDING, WINNIPEG
G. A. POWELL, Representative

Canadian Manager: G. C. ROYCE
22 Dundas St., WEST TORONTO

"Z" "Z"

# BUY
## Best and Brightest British Brand
# "Z" Tungsten Lamps

17 Watt, 20 ", 25 ", 40 ", 55 ", 100 ", 200 " } 100 to 135 Volts

STANDARD TYPES

40 Watt, 60 ", 80 ", 100 ", 200 " } 200 to 240 Volts

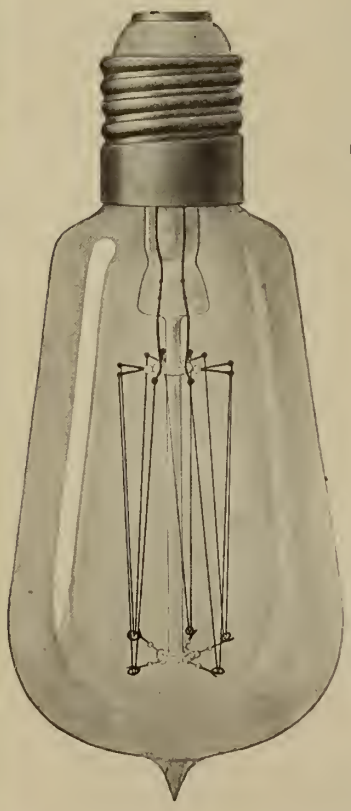
**High Efficiency, Competitive Prices, Strong Construction, Prompt Delivery.**

*Write us for prices and full particulars.*

## CHAPMAN & WALKER, Limited

**Corner Victoria and Lombard Streets, Toronto**

"Z" "Z"



# The "Just" Tungsten Lamp

CAN BE USED AT ANY ANGLE

**The Lamp That Saves You 90% of Your Light Bill**

16, 25, 40, 50 and 100 C. P.

LIFE - 1,000 Hours.

We have them from 50c. up.

BETTER LET US QUOTE YOU.

## Sterling Electric Supply Co., LIMITED

"Something Electrical for Everybody."

369 YONGE ST. Phone M. 3084 TORONTO, ONT.

# To the **Central Station Engineers** of Canada

A number of Central Stations have already requested our services for their *annual Fall preparation* for the heavy winter load, but there are a number of you from whom we have not heard.

We wish to thank those of you who have favored us with orders and also to assure the hesitant ones that their work will receive the same *careful and prompt attention* which has made our old customers our good business friends.

When sending in your work, we would be pleased to have your suggestions for changes your daily observation of the machine has shown necessary.

*REMEMBER*

## The Electrical Maintenance & Repairs Co.

**162 Adelaide Street West, TORONTO**
**Phone Main 3419**

*The Specialists in the Cure of Electrical Diseases.*

# The General Electric Manufacturing Co. of Sweden

**FOUNDED 1883**
**Factories in Westeras, Sweden; London, England; Helsingfors, Finland.**

**(ALLMANNA SVENSKA ELEKTRISKA)**

4,500 K.W., 257 R.P.M., 6,600 Volt., A.C. Generator, Water-wheel Type.

**Some reasons why you should consider our apparatus:**

- Moderate prices.
- All apparatus guaranteed during one year.
- 25 years of experience in the design and manufacture of electrical apparatus.
- Extremely rugged and reliable construction.
- Only best grade Swedish iron and steel used.
- Highest efficiencies.
- Spare parts carried in stock in Toronto.
- Our own skilled labor for erection and repairs.
- Actual shipping time only three weeks between factory and Ontario points.
- 3-Phase Motors in stock in Toronto.

*We solicit an opportunity of tendering on all your requirements.*

**REPRESENTATIVES IN CANADA:**

## Kilmer, Pullen & Burnham,

**508 McKinnon Building, TORONTO**

TRADE MARK J.M.T. REGISTERED
A GUARANTEE OF QUALITY

**Manufacturers of a complete line of**

Our goods are made with the utmost care and precision.

# Steam Gauges

Our gauges can be relied upon to register the *correct pressure* at all times.

Standard Single Spring and Improved Double Spring Gauges
Compound Pressure and Vacuum Gauges
Improved Locomotive Gauges
Combination Water Works Gauges
Altitude Gauges

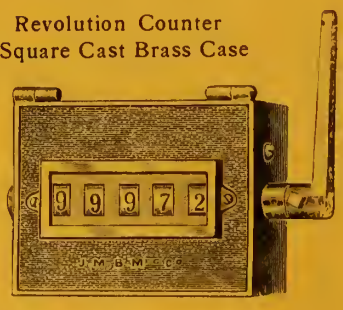
Air Brake Gauge with Electric Dial-Lamp

Pressure Recording Gauge—With Removable Chart Keeps Daily Record of Pressures Carried.

Vacuum Gauges
Hydraulic or Hydrostatic Gauges
Pyrometer Gauges
Improved Standard Test Gauges
Ammonia Gauges
Illuminated Dial Pressure Gauges
Pressure Gauge Testers
Inspectors' Test Pump and Gauge Outfits

Standard Air Brake Gauge

Revolution Counter Square Cast Brass Case




Revolution Counter in Round Cast Brass Case

THE
## James Morrison Brass Mfg. Co.
LIMITED

Steam Specialties — 93-97 Adelaide St. West - - - TORONTO — Engineers' Supplies

CIRCULATES IN EVERY PROVINCE OF CANADA

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Ltd.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C

Vol. II. Publication Office, Toronto—November, 1909 No. 11

TRADE PENBERTHY MARK

Automatic Injector

WITH A QUARTER CENTURY REPUTATION

THE WORLD'S STANDARD BOILER FEEDER

PENBERTHY INJECTOR CO., Limited, WINDSOR, ONT.

# POWER PLANT EQUIPMENT

**ENGINES**
**BOILERS**
**PUMPS**
**CONDENSERS**
**FEED-WATER HEATERS**

*The Deane Triplex Power Pump can be furnished for gearing, belting or direct drive in all sizes for pressures up to 1,000 lbs. per sq. in.*

*The Erie City "Counter Current" Feed Water Heater will save its cost in economy of coal the first year.*

*Worthington Boiler Feed Pump.*

***A large stock of these pumps is carried ready for immediate shipment.***

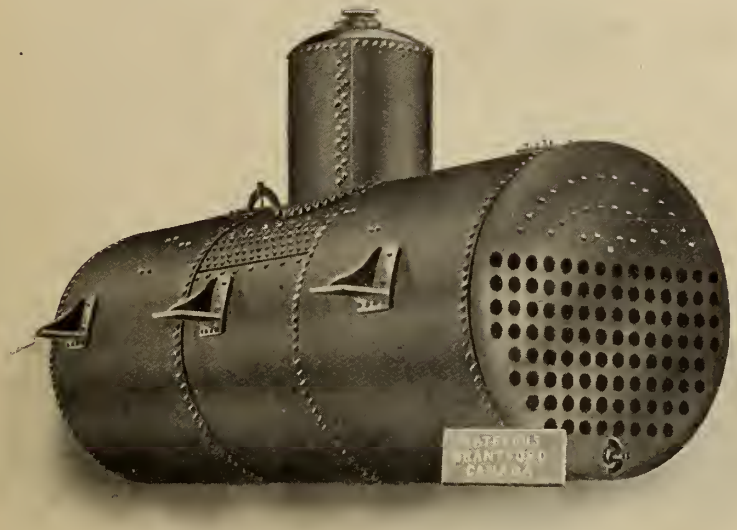
---

## THE JOHN McDOUGALL CALEDONIAN IRON WORKS CO.

LIMITED

**Sales Offices:** MONTREAL, TORONTO, COBALT, WINNIPEG, CALGARY, VANCOUVER.

# POWER PLANTS



WE MANUFACTURE

## BOILERS

Return Tubular, Locomotive, Scotch, Upright and Marine.

## ENGINES

McEwen Automatic—Simple or Compound.

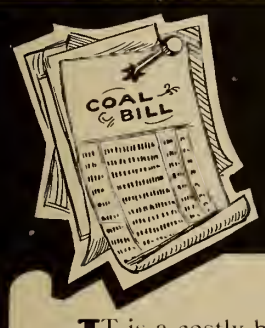
## ALL STEAM PLANT ACCESSORIES

Write for Prices and Bulletins

## THE WATEROUS ENGINE WORKS CO., Limited

BRANTFORD - CANADA

Western Branch : Winnipeg, Man. B.C. Agent: H. B. Gilmour, Vancouver




# BOILER SCALE IS A LUXURY!

IT is a costly business to allow scale to form in boiler tubes, because a scaly boiler requires *more coal* and *more attention* to keep up steam. And it's a *costly business* to remove hard scale by *mechanical contrivances*—to say nothing of the injury such treatment causes the boiler. The one *logical* method of overcoming boiler scale is to *prevent* scale from forming; and the one logical method of prevention is **"RED STAR"** Boiler Compound, made up *after* an analysis of the feed-water.

We *don't* carry a *stock* of **"RED STAR"** Compound—every pound of it is made up *after analysis* and to suit the special circumstances of the case. Every pound of it is *absolutely guaranteed* to remove old scale and to prevent new scale formation.

Every user of **"RED STAR"** Compound is loaned one of our Perfection Automatic Back Pressure Boiler Compound Feeders, absolutely free of charge.

*Send us a gallon of your feed water for FREE ANALYSIS*

## HYGIENIC LABORATORIES, Limited

11 COLBORNE STREET - - - - - - - - TORONTO, CANADA

# RED STAR COMPOUND KILLS SCALE!

THE POWER HOUSE R

# Here's a Strong Statement!

But one to the truth of which thousands of Boiler-Owners can testify.

In point of ECONOMY, DURABILITY, and EFFICIENCY and SAFETY the best on the market for every size of plant is the

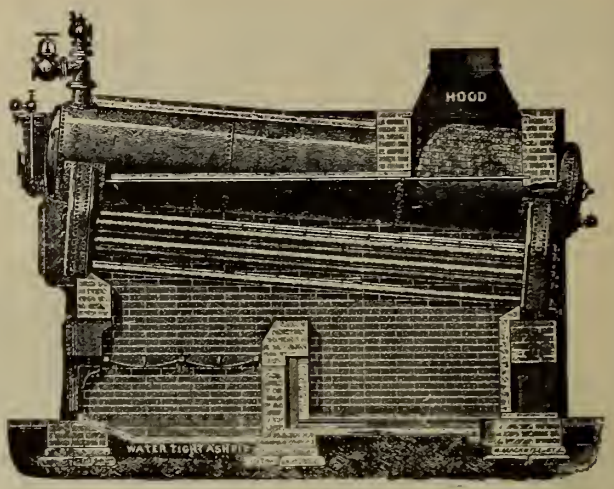



Fig. 1—Heine Boiler and Setting

# Heine Safety Boiler

¶ Its economy and capacity are determined by the fact that it is the best boiler for rapidly absorbing and transmitting heat; moreover it separates the water from the steam, thus ensuring the delivery of dry steam at the piston.

¶ Another feature is the HEINE DRUM which effectively precipitates and discharges all scale and mud from the boiler.

¶ The HEINE BOILER will hold high pressures with safety because of the careful selection of raw materials, the skill employed in every detail of its manufacture, and the numerous severe tests to which it is subjected both during the making and after it has been put together as a completed boiler.

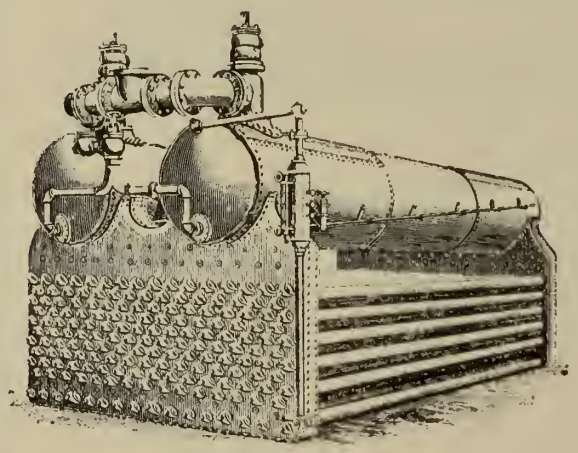


Fig. 2. The Heine Boiler Without Brick Setting.

As an actual or prospective buyer you are invited to make the fullest enquiries. Our literature will interest you—

Write for it to-day.

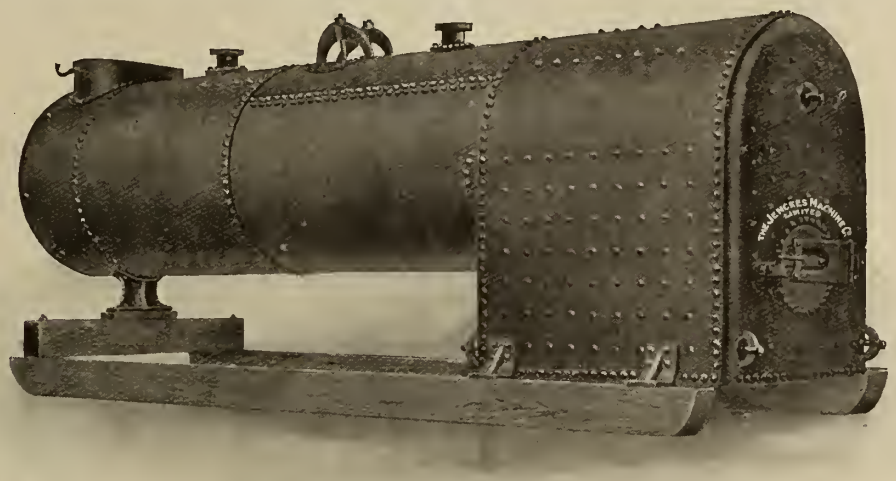
125,000,000 horse power of HEINE BOILERS in use in United States at the present time.

## Polson Iron Works, Ltd.

TORONTO - CANADA

# Locomotive Type Boiler—Class "D"

Write for Prices




Write for Catalogue

OPEN BOTTOM PATTERN

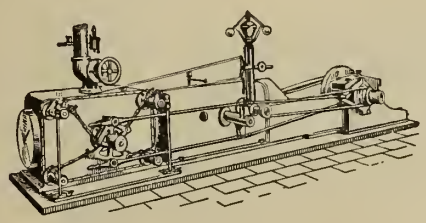
## THE JENCKES MACHINE COMPANY, Limited

GENERAL OFFICES: Sherbrooke, Quebec WORKS: Sherbrooke, Quebec; St. Catharines, Ontario

SALES OFFICES: Sherbrooke, St. Catharines, Cobalt, Vancouver, Montreal

# ENGINES—

Leonard Corliss, Automatic High Speed, Leonard Tangye and Clipper



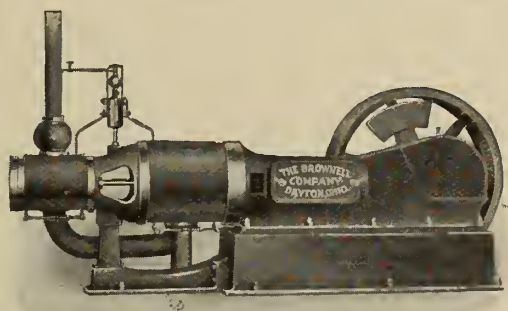
# BOILERS—

Horizontal Tubular, Locomotive (on Skids or Wheels), Eclipse Semi-Portable, Upright.

*Complete Steam Plants contracted for.*

## E. LEONARD & SONS

LONDON, - ONT.




## The Brownell Company

Dayton, - Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

925 Monadnock Bldg., Chicago, Ill.

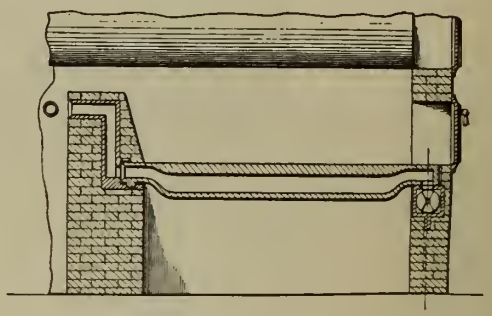
Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# FLEMING GRATE BARS

save all the way from 10% to 35% of fuel. We guarantee at least 10%. A set of bars installed upon a 30 days' trial.



FURTHER PARTICULARS UPON APPLICATION

## BUTTERWORTH FOUNDRY, LIMITED

BROAD STREET : OTTAWA, ONTARIO

NEW MODEL

## Diamond Shaking and Dumping Grate Bar

Brick Yard Castings at Lowest Prices

Canadian Patent 118778

Boiler Room Supplies of All Kinds

**The Diamond Grate Bar** is protected by Letters Patent and all our customers can be assured that they are getting the most up-to-date Shaking and Dumping Bar in the market to-day. We don't claim that our bar is everlasting, but we do claim that, with ordinary care, it will last longer than any other and burn all grades of fuel with good results.

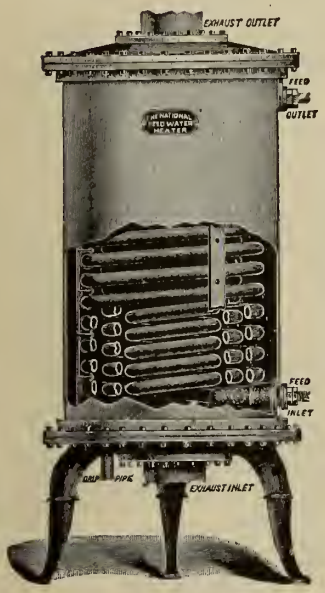
## The Diamond Grate Bar Co.

Head Office:
BERLIN, ONT.

Branch:
Room 119 St. James Chambers
Tel. M. 1342 TORONTO

# The National Feed Water Heater

## Thousands of Horse Power in Use in Canada




The reason more National Feed Water Heaters than any other make have been sold in the past twenty years is because they are more practical and efficient.

Their construction is **simplicity itself.**

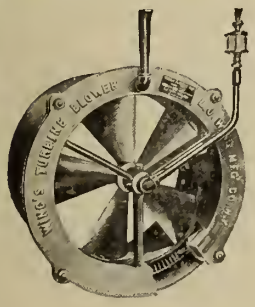
From one to fourteen coils of **seamless drawn** brass or copper **tubing** are encased in a **cast-iron or steel shell** to which **exhaust steam** is admitted, heating the water passing through the tubing. All joints are brazed—**leaking is impossible.** There is no boiler pressure on the shell at any time and the **shell never wears out.**

There is an interesting catalog of the National Feed Water Heater which you may have for the asking. **Write for it to-day.**

## THE NATIONAL PIPE BENDING CO.

91 LLOYD STREET

New Haven, - - - Connecticut



## "WING" TURBINE BLOWER SYSTEM OF FORCED DRAFT.

Cost Small and Efficiency Great

*Write for particulars*

## RUSSEL & GIFFORD

MONTREAL ——— TORONTO

## MOREHEAD

SAVES FUEL

SAVES LABOR

## RETURN NON-RETURN & VACUUM

WE are so absolutely confident of the successful and satisfactory operation of our traps that we will send them on a 30 days' free trial period. State your conditions and let us send a "Morehead."

Write for "Trap Book"

**MOREHEAD MFG. CO.**

1021 Grand River Avenue, - - DETROIT, MICH.

Canadian Representatives:

A. R. WILLIAMS MACHINERY CO., Toronto, Ont.

W. H. MARKLE, Montreal, Que. PARK BROS., Chatham, Ont.

## STEAM TRAPS AND BOILER FEEDS

# JENKINS BROS.' VALVES

## IRON BODY—BRASS MOUNTED

ALL REGULAR SIZES AND STYLES NOW
MADE AT OUR NEW PLANT IN MONTREAL

Bodies made of best Grey Iron. Wearing parts of highest grade Steam Metal.
All parts interchangeable. Can be repacked while under pressure and wide open.
Well designed and carefully built. Every valve tested. Have wide margin of safety.

**ACKNOWLEDGED THE BEST STEAM VALVES MADE**

Extra Heavy Iron Body Globe, Angle and Gate Valves, for 250 lbs. Working Steam Pressure.

Catalog and full particulars on application

## JENKINS BROS. LIMITED

102 St. Remi St., MONTREAL

# DART FLANGE UNIONS

MEET A LONG-FELT WANT

HAVE YOU TRIED THEM?

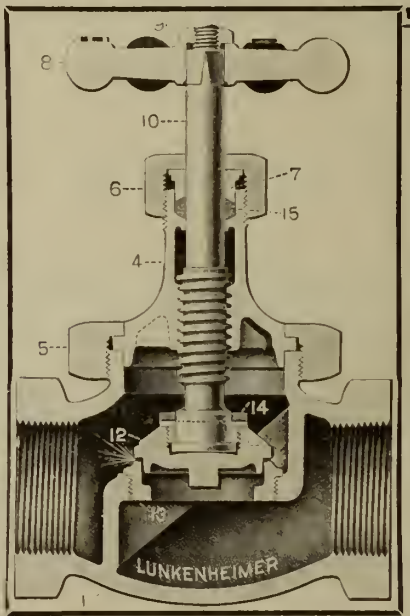
THEY ARE RIGHT

## ALWAYS TIGHT

THE JOINT IS BRONZE AGAINST BRONZE

## DART UNION CO., LTD.

TORONTO - - ONTARIO




The SEAT in this valve is SELF-CLEANSING, both DISC and SEAT are RENEWABLE, but can also be REGROUND. These Features make the

**LUNKENHEIMER "RENEWO" VALVE**

practically indestructible, and outlast the life of the pipe. The seat is made of a HARD, CLOSE-GRAINED NICKEL, and is very durable. All other parts are made of the highest grade of bronze composition.

WRITE FOR CATALOG

"Most supply houses sell them, yours can; if they don't or won't, tell us."

## The LUNKENHEIMER CO.

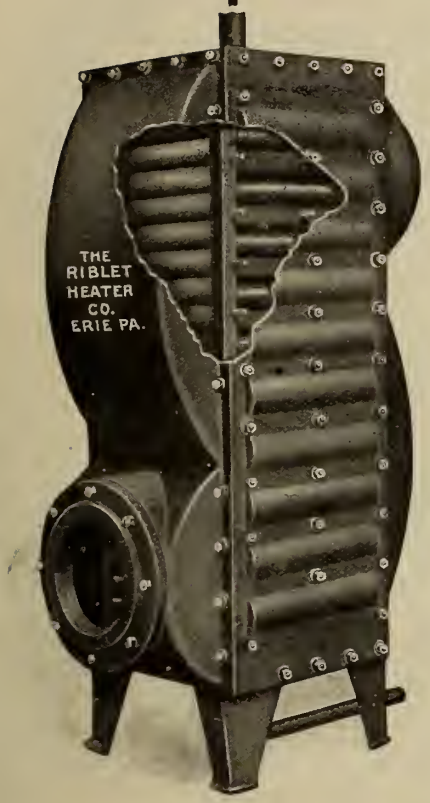
LARGEST MANUFACTURERS OF HIGH-GRADE ENGINEERING SPECIALTIES IN THE WORLD

General Offices & Works, CINCINNATI, Ohio, U.S.A.

BRANCHES { New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E., 35 Great Dover St.

36

The advertiser would like to know where you saw his advertisement—tell him.




# Practise Economy

by utilizing the exhaust from either Steam or Gas Engine to HEAT WATER!

Do you realize that you are only getting the use of 30% of the heat value of the gas in your engine? You can utilise a large part of the heat now being wasted by installing a

## Transverse Current Water Heater

**Some facts concerning this heater. Do they interest you?**

¶ Being made of cast iron it does not readily corrode and is not affected by electrolysis or acids.

¶ Has all the good features of both the closed and open type of heaters —no tubes to scale, no joints to leak, no floats to require attention.

¶ It is practically self-cleaning, as scale does not readily adhere to cast iron. The water passages are all easily accessible for cleaning if necessary.

¶ No Oil Separator needed and can't possibly get out of order.

**Send for Complete Descriptive Booklet.**

## THE RIBLET HEATER COMPANY

**Box 18, - ERIE, PA., U. S. A.**

MORE POWER FOR THE SAME MONEY OR THE SAME POWER FOR LESS MONEY

## TURBO BLOWER

## The Turbo-Blower System OF Mechanical Draft

will maintain a uniform steam pressure at all times, and allow the use of the cheapest grade of fuel.

**IF YOU HAVE TROUBLE**

in keeping up steam due to bad fuel, "peak" loads or insufficient draft—

**WRITE TO US**

**11 ORDERS SHIPPED TO CANADA LAST MONTH**

*"THERE IS A REASON"*

**TURBO-BLOWER CO.** 30 CHURCH ST. NEW YORK, N.Y.

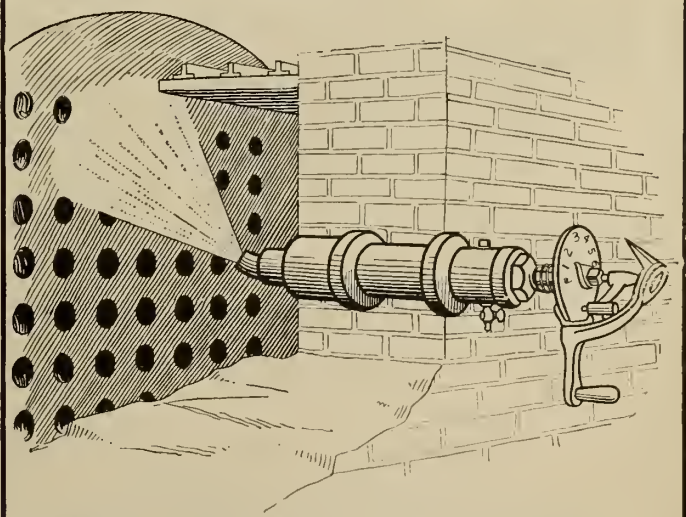
For Eastern Canada:

W. H. Adams - - - - 102 Nazareth St., Montreal

For Western Canada:

Standard Engineering Co., Ltd., 47 Wellington St. E., Toronto

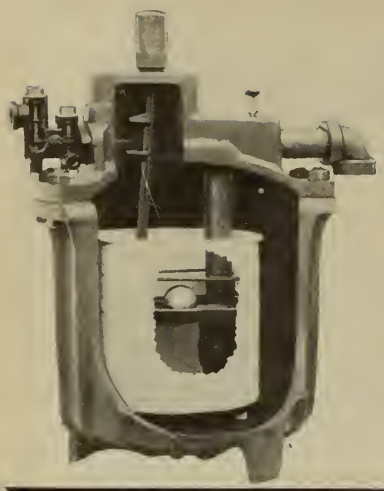
## Diamond Steam Flue Blower



**Will save its cost in a short time, and continue thereafter a permanent dividend-paying investment year in and year out. The only scientific machine for the purpose. Sent on 30 days' trial.**

## Diamond Power Specialty Co.

**317 Fort Street W., Detroit, Michigan**



# A Steam Trap
with
# 40 Years' Experience Behind It.

We patented the first Return Trap in 1872 and have made a specialty of them ever since. Other firms have sprung up and imitated. Some have failed, but we are still making new friends and retaining the old ones. Only **one** reason for that :—**We deliver the goods.**

Get the Trap with brains in it. They pay!!! May we send literature?

**THE ALBANY STEAM TRAP CO.**
317 N. Pearl St., - ALBANY, N.Y.

# The Nichols Chemical Company, Limited

HEAD OFFICE: 222 ST. JAMES ST., MONTREAL

# ACIDS AND CHEMICALS

WORKS:
Capelton, Que.
Sulphide, Ont.
Barnet, B.C.

**TRI-SODIUM PHOSPHATE**
Purest Commercial, 100%, for prevention of scale in boilers.

WAREHOUSES:
Toronto, Ont.
Montreal, Que.

# Quality—Efficiency—Reliability

These, together with reasonable cost, have established the reputation of

**Mason** Reducing Valves, Pump Pressure and Speed Regulators, Damper Regulators, Balanced Valves.

**Reilly** Multicoil Feed Water Heaters, Condensers and Evaporators—the most compact and efficient.

*It is not what you pay for an article, but what the article pays you in return for its cost, that determines its real value. . . . . .*

(Genuine)
**Ashton** Pop Valves, Relief Valves, Pressure & Vacuum Gauges, Alarm Gauges.

**Berry** Safety Automatic Boiler Feed Control—the simplest and best.

## Bundy Steam Traps and Separators

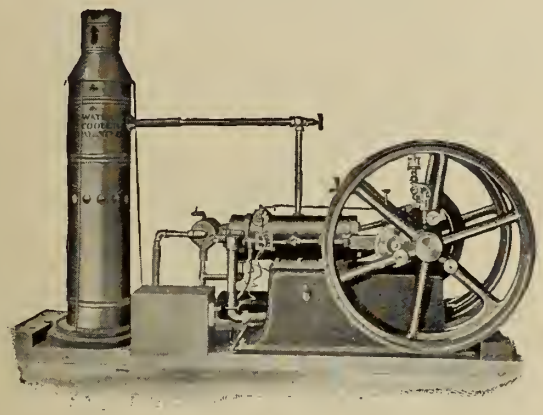
We design complete systems for returning condensation direct to the boilers, and we can effect economies in most steam plants.

*Catalogues and full information are at your disposal.*

**PEILER & MACKENZIE, -** 52 St. James Street MONTREAL

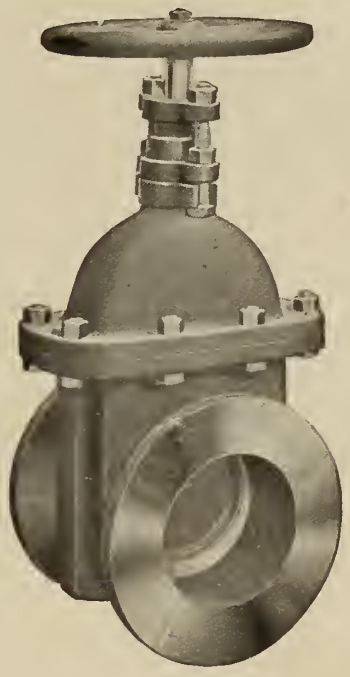
# GAS and GASOLINE ENGINES

## 1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

**Goold, Shapley & Muir Co.**
Limited
BRANTFORD - CANADA



## KERR GATE VALVES

*are to be found in all well equipped steam plants in Canada.*

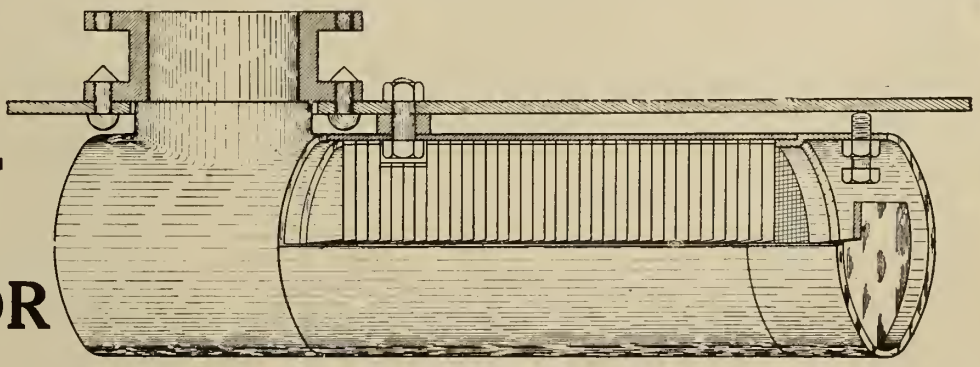
*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

**The Kerr Engine Co., Limited**
*Valve Manufacturers*
*Walkerville, - Ontario*

# WET STEAM IS UNNECESSARY, EXPENSIVE AND DANGEROUS!

## IDEAL INTERNAL STEAM SEPARATOR



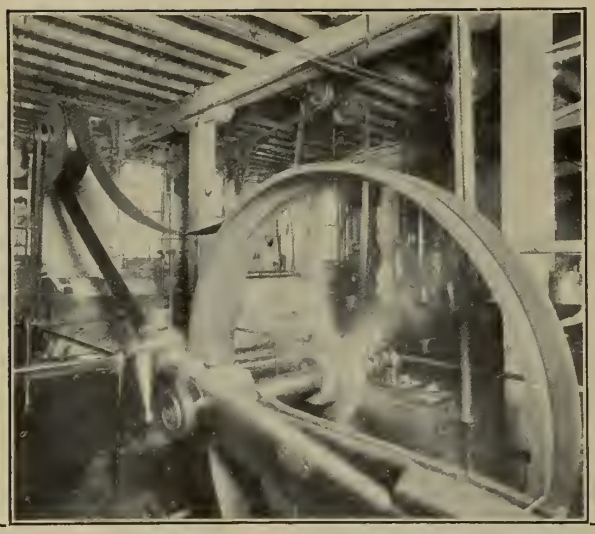
Absolutely safeguards your engine against damage through water-shock or the going-out of cylinder heads. It makes for economy by saving oil, packing and time, and by lessening the wear and tear of engines, pumps and compressors. Remember the first cost is the only cost! The "Ideal" requires no subsequent attention.

*Other lines, each having distinctive features:*
POTTER SEPARATORS; WHALEY AUTOMATIC SMOKE PREVENTERS; LEONHARDT GAUGE GLASS PROTECTORS
*WRITE FOR DETAILS AND PRICES*

*We are Selling Agents for:*
WATSON & McDANIEL CO., Philadelphia, (Steam Traps, etc)
SIMS' FEED WATER HEATERS, Erie, Pa.;
HARRIS SMOKELESS FURNACE CO., Nashville, Tenn.
*WRITE FOR CATALOGUES*

## IDEAL STEAM SEPARATOR AND SUPPLY CO.

820 Euclid Avenue, TORONTO, Canada



# Cling-Surface
## For Canadian Belts

There is, without doubt, more Cling-Surface used in Canada than the total of all other materials.

Because only Cling-Surface will permit all belts and ropes to be run easy or slack and carry full loads, and at the same time make and keep them pliable, water-proof and preserved.

It contains no rosin and is not sticky, but penetrates *into* the belts and ropes, where they need it.

The running of belts slack means ease on belts, bearings, shafting and engine, cool bearings, economy of oil, saving of the time and labor in keeping belts tight and increased power at machines.

This belt has run 6 years in the I.X.L. Laundry, Toronto, with Cling-Surface, in heat and steam. It is 9" leather, 8' to 42" pulleys, 17' centers, 45 H.P. load when photographed, 2050 ft. P.M. 40" slack, and never slips.

We guarantee Cling-Surface to give you the best belt service you ever had. We quote f.o.b. Toronto, duty paid. Write for special trial terms and printed matter. Write now.

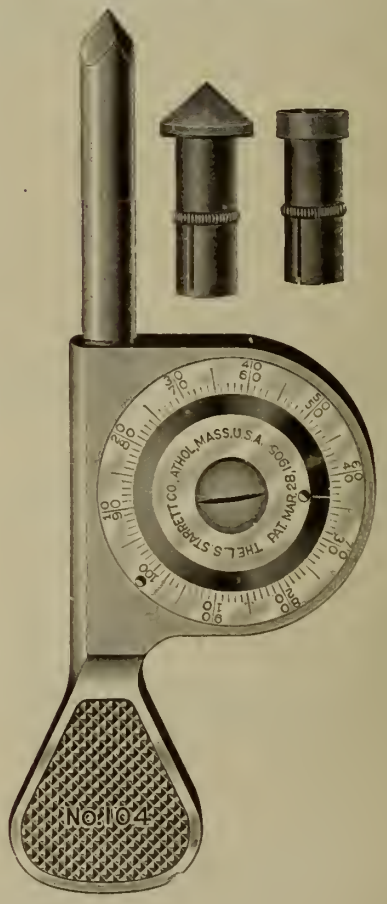
**Cling-Surface Company**

**1057 Niagara Street, Buffalo, N.Y.**

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE," by sending two new paid-up subscriptions ; If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**




"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

**PUBLISHED MONTHLY AT $1.00 PER YEAR.**
**Start in TO-DAY to earn one of these handy Tools.**

**THE POWER HOUSE**
**10 Front Street East TORONTO**

*No belt can be better than the leather from which it is made.*

It pays to use "D. K. McLaren" Belting for the simple reason that it will do what is expected of it under all circumstances. Every inch of it is thoroughly reliable. If you are an exclusive user of "D. K. McLaren" Belting you will never know what belting troubles are. You can get a grade of "D. K. McLaren" Belting to suit every purpose from the running of the smallest machines up to main drive belts for the heaviest class of work.

**WRITE FOR OUR CATALOG.**

# D. K. McLaren, Limited

**MONTREAL,** 309-311 Craig St. West **TORONTO,** 200 King St. West
**QUEBEC,** 21 St. Peter St. **ST. JOHN, N. B.,** 64 Prince William St.
**VANCOUVER, B. C.,** 418 Abbott Street.

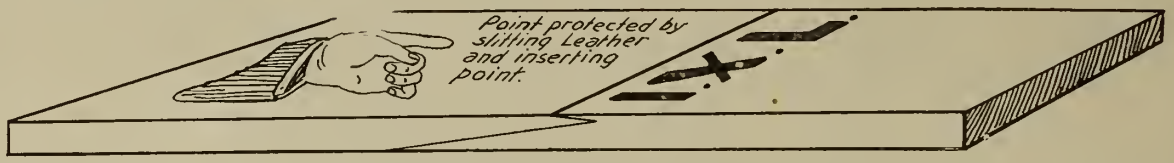
**Full Stock of our Extra "C" and Standard "B"**

**at all our warehouses.**

*"D. K. McLaren" Belting is made from the best British Oak Tanned Leather. Better belts cannot be made.*

# THE "I.X.L." SPLICE

"THE BELTING SPLICE THAT WILL NEVER COME OPEN"




The great trouble with *any* belting—no matter how good the leather—that is joined up with the ordinary splice, is the fact that the splices come open, causing loss and delay. J. D. McArthur's Leather Belting made with the "I.X.L." SPLICE, as shown in this cut, *cannot* come open at the splices. Note the protected point, outside point running same direction as pulley.

J. D. McArthur's Leather Belting is made from Prime British Oak-Tanned Leather, from Close-Trimmed Backs exclusively.

Write for our complete price list.

J. D. McARTHUR & CO., Brockville, Ontario

Stock at Toronto Branch 639 King St. East; J. E. Stephenson & Co., Agents

## PLOMO BELT DRESSING

Can be used with perfect satisfaction on any kind of belting, whether rubber, leather, rawhide or canvas. Is very economical—a spoonful will dress an 8-inch belt 100 feet long. Especially adapted for dressing belts running in damp, hot or dusty places. Permits belts to be run slack without slipping—slack belts wear longer and minimize the wear in the bearings and the strain on the hangers and shafting.

*Write for booklet and 25 lb. package on trial.*

**THE PLOMO SPECIALTY MFG. CO.**
**CLEVELAND, OHIO.**

## WATER POWER

**By J. P. Frizell**

An outline of the Development and Application of the Energy of Flowing Water. Contents include: Natural Watercourses, Dams of every description, anals, H ydraulic Motors, Turbines, Development of Natural Water Powers, Transmission of Power, Hydraulic Transmission, The Power House, Transmission by Electric Current, etc.

658 PAGES 251 ILLUSTRATIONS

**Price $5.00, postpaid**

**MACLEAN PUBLISHING COMPANY**
**TECHNICAL BOOK DEPARTMENT**
**10 Front St East - - Toronto**

# Every Maker of Belts Aims to make the Best But:— Lots of them are pretty poor marksmen

We have been concentrating all our efforts for many years to improve our aim, and results have shown that we hit the bull's-eye 99 times out of 100 shots. A broad statement? Yes, but backed up evey time by our

# Genuine Bark Tanned Leather Belting

Our good scores are made possible by the use of the very highest grades of weapons and ammunition, consisting of:

Experience, Expert Workmanship, Slow Process Tannage and Selected Hides

The resultant Brands are

## "EXTRA" "STANDARD" "ACME WATERPROOF"

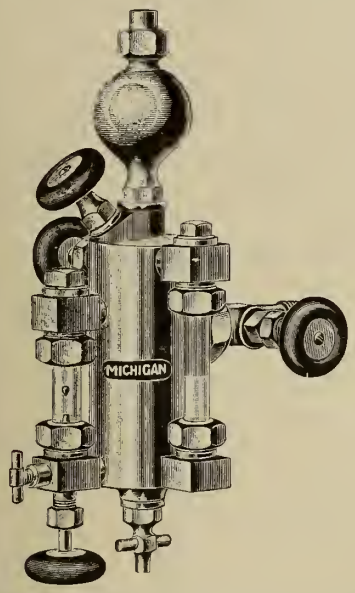
The marksmen are

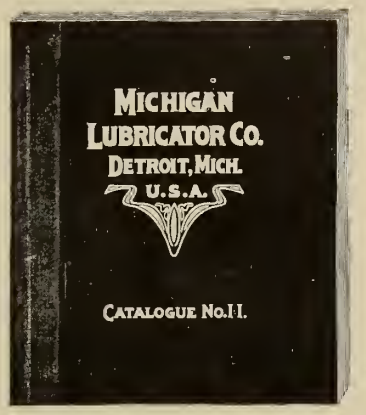
## J. L. GOODHUE & CO. DANVILLE, P.Q.

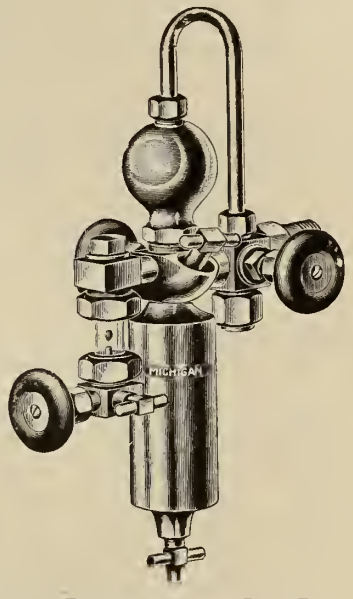
Let us quote on your next requirements.

# MICHIGAN

Illustrated catalog mailed to you free




WRITE TO-DAY

## MICHIGAN LUBRICATOR CO.

DETROIT, MICH.

## EVERY ENGINEER

## SHOULD KNOW

ALL ABOUT

**WEAR WELL** LEATHER PACKINGS

You have packing troubles and have never known where to procure Packings that would give satisfactory service. We manufacture "Wear Well Leather Packings" from the highest quality of leather, work to your specifications and guarantee every Packing to give satisfaction.

Made in all sizes and styles for use in Hydraulic and Compressed Air Machinery. Write for descriptive booklet.

## Detroit Leather Specialty Company, Inc.

DETROIT 87 Beecher Avenue MICHIGAN

# COAL

## Jules G. Hoffman

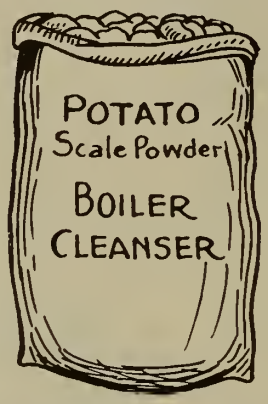
Miner and Shipper
of

**High-Grade Steam & Gas Coals**

**Blacksmith Coal & Coke**

Quality Guaranteed

General Offices - - 420-423 Hammond Bldg.
Detroit, Michigan, : : : U. S. A.




### Think What This Means To You

Every time any scale forms on your boiler, more coal must be used to heat the scale before it heats the water.

Then, too, there is the expense of cleaners, cleaning and time lost in the operation.

So that if you can get rid of your scale, it means less coal for the same amount of steam evaporated, and no expense for tube cleaners. My

**Potato Scale Boiler Cleanser**

will positively obviate scale in your boiler without doing damage to shell, pipes or connections.

Mail me a sample of the water you use, and I will prove I can make good my statements.

SOLE AGENT FOR AMERICA.

## C. C. SNOWDON

Wholesale Oil Merchant — CALGARY, Alta.

Branch Stores in New York and Montreal

Address all letters to Calgary.

# "By the way," have you tried our

Harris Heavy Pressure-Bearing Metal?

You will never regret a trial order

Price 22c. per lb.

Manufactured and Guaranteed by

# The Canada Metal Co., Ltd., Toronto

# Steamfitters Save Time -and Dollars

The old—and expensive—way of connecting up tubing or piping was by soldering, flaring out the ends of piping or tubing, threading the ends, and other methods just as crude. It called for a pipe vise and bench, a full set of dies and taps and an assortment of Stilson wrenches.

These old methods are slow. They take too long and *cost too many real dollars* to be practical under modern conditions.

The *new* way—the *quick* way—the *economical* way of connecting up piping and tubing is by using

## Union Cinch Fittings

which eliminate soldering, flaring out and threading ends and make the use of cement and solder *quite unnecessary.* The only tools required being a hack saw, a file and a wrench.

Every Union Cinch Fitting is a *Union.* To make the connection simply slip the shell over the end, push the pipe into the fitting and draw the nut over same That's all.

*Advanced ideas on the subject are in Bulletin No. 210-I.*

**SIGHT FEED OIL PUMP CO.**

**Milwaukee**

*"ECLIPSED BY NONE."*

## Walker's Electric Boiler Compound

**The Electric Boiler Compound Co., Limited**

***GUELPH, ONT.***

**CYLINDER OILS**

Regal Valve, Red Star, Monarch, Low Pressure.

**ENGINE AND MACHINE OILS**

Superior, Electric, Gas, Ideal Press, Vulcan Machine. Heavy Red.

Flue Cleaners, Lace Leather, Graphite, Gauge Glasses, Compression Greases, and all Engine Supplies.

**SPECIALTY DEPARTMENT**

Waxine Floor Oil. Tri Sodium Phosphate.

**FLEXIBLE RUBBER ROOF PAINT**

PRICES ON APPLICATION

***CORRESPONDENCE INVITED.***

# 25 Horse Power Gas Engine

used only

# 118 Pounds of Pea Coal per Day

(10-hour day, including 2 hours over-load)

## Can your best showing equal this?

The Plant is The Standard Foundry Co., Longueuil, P.Q.

The Producer is The Dominion Suction Producer.

The Engine is a Tangye Gas Engine.

and you can learn more facts about them from

**The Canada Gas Power & Fuel Co., St. James St. 68 Montreal**

## To Users of Water Power

Are you quite certain that you are getting the best results from your water wheels? We would like you to see our Catalog, which gives accurately compiled tables showing the power-producing capacity of the

# TRIUMPH

## Turbine Water Wheel

We guarantee that the Triumph Turbine will furnish more power according to diameter, and give greater efficiency at all stages of Gate Opening than any other Turbine on the market. In our standard style, with vertical shaft, the runner is a single downward discharge, conical in shape, and the buckets are wrought steel, with an outside band of cast iron. The gates are of the butterfly type and set on the same taper as the runner. It works equally well in a horizontal position.

WRITE TO-DAY FOR OUR CATALOGUE

**The Madison Williams Mfg. Co., Ltd.**
LINDSAY, ONTARIO, CANADA

## On Account

of their

Extremely Low Cost of

Operation and the Small

Amount of Attention

Required

## Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**
Coristine Bldg., Montreal
Phone Main 1054
*Works - - - - - Seneca Falls, N.Y.*

# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

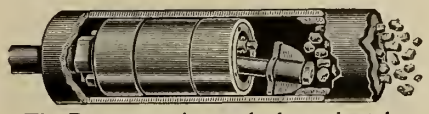
Can a true, progressive engineer afford to be outside of our organization ?

Remember that we will give methods of improvement to all our members desiring them.

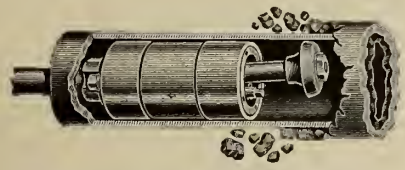
If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**
**Executive Secretary**
**MT. HAMILTON, - ONT.**



The Dean removing scale from the tube of a Water Tube Boiler.



The Dean removing scale from the tube of a Return Tubular Boiler.

## Are Your Boilers Operated Economically?

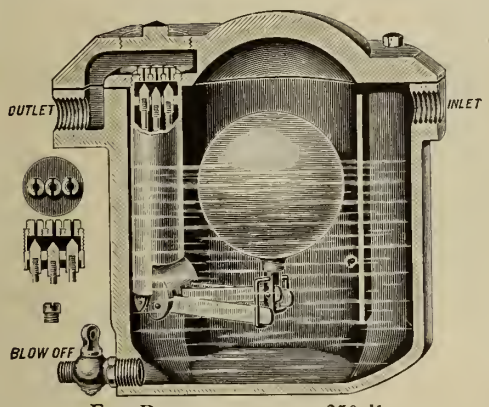
Wouldn't you like to cut down their fuel consumption—increase their steaming capacity—eliminate loosened and burned out tubes?

# The Dean Boiler Tube Cleaner

is what you need. You will have no idea of what scale is costing you until you see how much you can save after the Dean has thoroughly removed the scale from your boiler tubes.

"Scale Removal Made Easy"—yours for the asking.

**THE WM. B. PIERCE CO., - 330 Washington Street,**
BUFFALO, N.Y.




For Pressures up to 250 lbs.

## WRIGHT "EMERGENCY"

**High Pressure Continual Flow**

# STEAM TRAP

The "Emergency" trap drains the water from steam systems automatically and continually without steam waste and regardless of small flow or flood.

*Write for pamphlet W.*

**DARLING BROTHERS, LIMITED**
TORONTO 15 Ottawa St., MONTREAL WINNIPEG

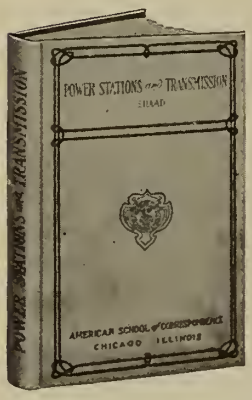
# "STEEL MIXTURE"

The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:—Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

**NEW YORK CITY BRANCH, 1402 BROADWAY** **McLEOD & HENRY CO.** **MAIN OFFICE & WORKS TROY, N.Y.**

# Practical Books For Engineers

The engineer who would be a success must supplement his practical work by the reading of standard works on engineering. We carry a complete stock of these books, among which are the following:—

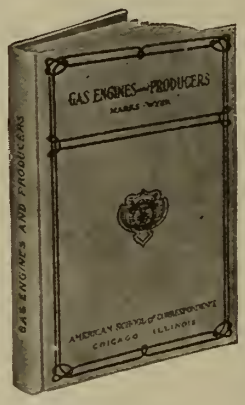



## Power Stations and Transmission

**By George C. Shaad, E.E.**

Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. 176 pp., 13 illus. Cloth binding. A manual for Electrical Engineers and Electrical Workers in general. It represents the accumulation of years of practical experience by the best authorities, and should be in the hands of every worker in the great field of electricity and of every other practical man, no matter what his business, who is interested in the development of electrical power.

**Price.....$1.00**




## Gas Engines and Producers

**By Lionel S. Marks, S.B., M.M.E.**

Assistant Professor of Mechanical Engineering, Harvard University, American Society of Mechanical Engineers, and Samuel S. Wyer, Mechanical Engineer, American Society of Mechanical Engineers. 160 pp., 90 illus. Cloth binding. Embodying the latest information in this rapidly developing field. Of immense practical value to all Engineers, Machinists, power-plant owners or managers, etc.,—in fact, all interested in efficient and economical power production.

**Price.....$1.00**

## New Catechism of Electricity

**By N. Hawkins, M.E.**

Price $2.00. 550 Pages, 300 Illustrations.

A practical treatise on the care and management of electric plants and apparatus—a book to aid the average man rather than the inventor or experimenter. It contains all the (book) information necessary for an experienced man to take charge of a dynamo or plant of any size. Contents include Dynamo, Electric Lighting, Electric Railway, Telephone and Telegraph, etc. Bound in red leather, pocket-book form.

## Modern Steam Engineering in Theory and Practice

**By G. D. Hiscox**

Price $3.00. 450 Pages, 400 Illustrations.

This book has been specially prepared for the use of the modern steam engineer, the technical students, and all who desire the latest and most reliable information on steam and steam boilers, the machinery of power, the steam turbine, electric power and lighting plants, etc.

**Further information regarding the above or other Engineering Books given on application to**

# MacLean Publishing Company

TECHNICAL BOOK DEPARTMENT

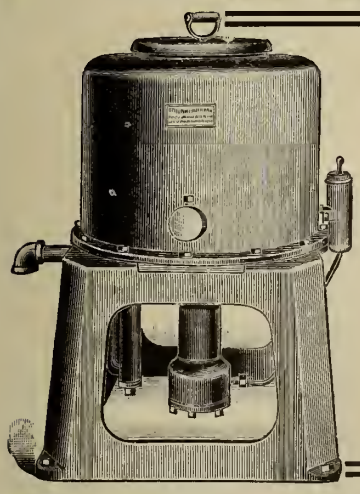
**10 Front St. East, - Toronto, Canada**

# Sadler & Haworth

ESTABLISHED • 1876

"CLIMAX" **In Oak Tanned Leather Belting These Brands Are the Best.** "AMPHIBIA" (WATERPROOF)

**Factories at Montreal and Toronto - Stock Depots : St. John, N. B., Winnipeg, Calgary, Vancouver**



## Save the Oil—Don't Waste Waste

You simply have to place the dirty waste in this machine, turn on the steam and in half an hour the waste is perfectly clean and the oil—90% of it—is ready for use again.

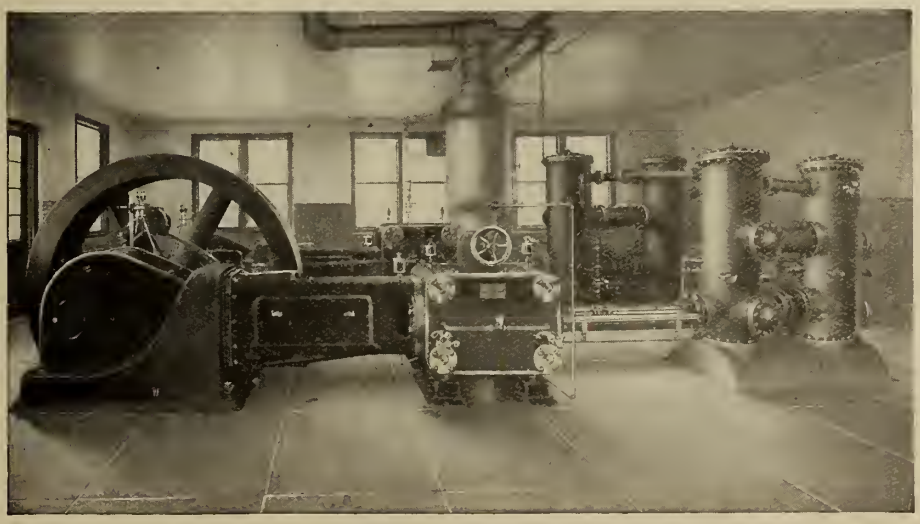
We have machines with—The E. B. Eddy Co., Ltd.; Grand Trunk Ry.; Canadian Pacific Ry.; Dominion Coal Co.; J. R. Booth; Toronto Water Works; T. Eaton Co.; Montreal Street Ry.; Nova Scotia Steel & Coal Co.; Toronto Railway; Algoma Steel Co.; Quaker Oats Co.; B. Greening Wire Co.; Imperial Oil Co.; Canadian Copper Co; Sarnia Electric Light Co.; Robt. Mitchell Co.; Montreal Rolling Mills; Canada Screw Co.; Crow's Nest Pass Coal Co.; Dominion Iron & Steel Co.; Temiskaming & Northern Ontario Railway Co.; Consolidated Mining & Smelting Co.; Montreal Cotton Co.; Frost & Wood Co., Ltd., and many others.

ASK FOR CATALOGUE

**The Canadian Oil and Waste Saving Machine Co.** Limited

BROCKVILLE, ONTARIO

# ROBB POWER PLANTS



## ENGINES

Corliss, Slide Valve, Horizontal, Vertical

## BOILERS

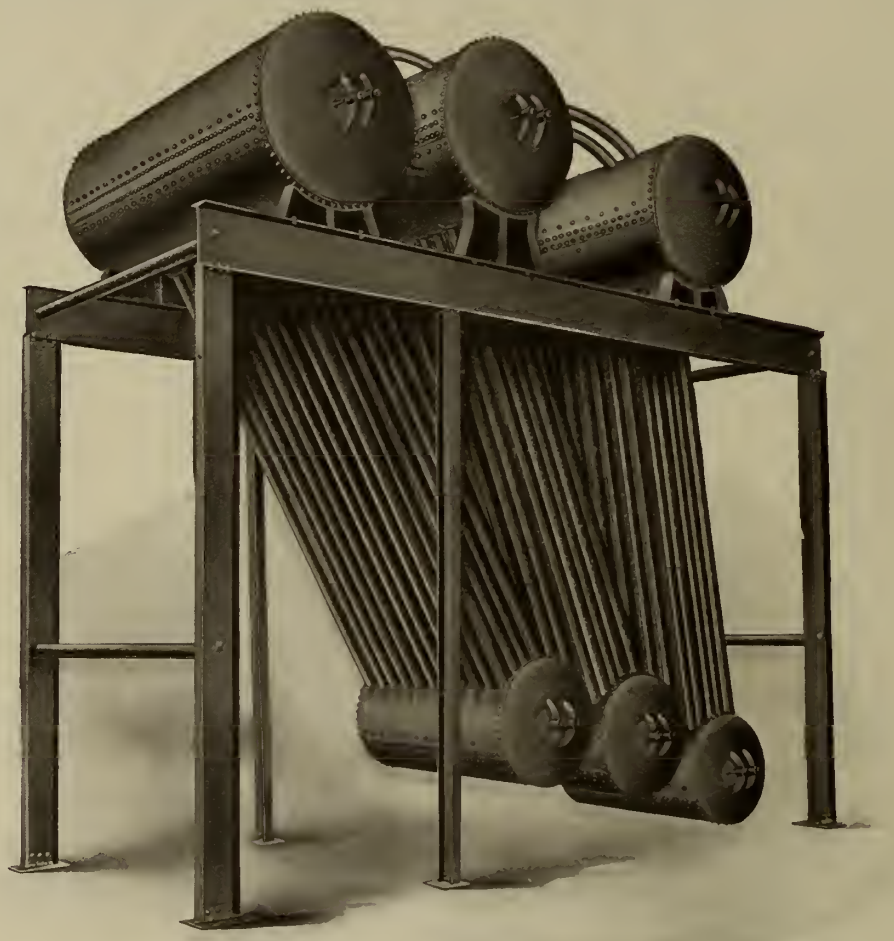
Return Tubular, Water Tube, Internally Fired, Portable

**Robb Engineering Co., Limited, Amherst, N.S.**

DISTRICT OFFICES
- 607 Canadian Express Building, MONTREAL; R. W. Robb, Manager.
- Traders Bank Building, TORONTO; Wm. McKay, Manager.
- Union Bank Building, WINNIPEG; W. F. Porter, Manager
- Calgary Block, CALGARY; J. F. Porter, Manager.

# Water Tube Boilers

## Return Tubular, Horizontal Marine, Vertical and Portable Boilers, with or without Wheels



Side View of our NEW WATER TUBE BOILER. Not bricked in.

## Our Engines, Boilers, Heaters, Pumps and Condensers are Prominent in Canada's Largest Power Houses.

## The Goldie & McCulloch Co., Ltd.

### Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

BRITISH COLUMBIA AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Boilers, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

Ask for Catalogues, Prices and All Information.

# The Campaign in Canada for Uniform Boiler Laws.

## Meeting of Representatives of Various Provinces in Regina, Sask., Dec. 1st., to Consider Uniform Law – Ontario's Representation.

Since its inception, The Power House has followed closely the campaign to secure uniform boiler legislation in the varions provinces of Canada. The manufacturers and engineers of Canada have recognized fully the importance of building boilers acceptable in any province in the Dominion. Now the realization of the hopes of manufacturer and consumer is in sight. For several months J. W. Harkom has interviewed the men in charge of boiler inspection, construction and stationary engineering departments, with the result that British Columbia,, Alberta, Saskatchewan, Manitoba, Ontario and Quebec will be represented in a conference at Regina December 1, 1909. The representatives will attend with instructions to consider the act prepared by the Boiler and Engine, and Boiler and Thresher sections of the Canadian Mannfacturers' Association, and bring to the Provincial Governments recommendations which can be adopted by them and stimulate, instead of retarding, the trade between provinces.

As the laws stand at present, a boiler built to the specifications of one province will not be acceptable in another province, and the effect has been to stop, or at least curtail, business carried on between provinces. This appears to us to be striking a blow at the British North America Act of 1867. One of the important features of the act was to remove the barriers preventing provinces trading with each other.

The benefits of a uniform law are threefold: (1) The manufacturer will be able to build a number of boilers on the same pattern, allowing him to build a better boiler, because the numerous patterns, templets, etc., are done away with, and workmen can become more efficient; (2) The consnmer will know that he is getting a boiler that can be nsed in any province; (3) any engineer securing a certificate in one province and moving to another will not have to pass examinations in all the provinces in which he may reside.

The act and regulations that have been prepared cover the ground very thoroughly. The differences in opinion manifested by the legislation in the various provinces should be easily reconciled. The time has arrived when greater protection is necessary. A strict, uniform law will carry out the spirit of the British North America Act, and will protect to a greater extent, life and property, and guarantee to the user that all precautions have been exercised in the manufacture to secure for the user a well-constructed boiler.

### The Representatives.

The Canadian Manufacturers' Association will be represented by J. W. Harkom, who has been instrumental in bringing the meeting about, and who has assisted in the preparation of an act and regulations, which will be submitted at the Regina conference.

British Columbia will be represented by J. Peck, while Duncan Metcalfe, of the Department of Public Works, has been named by the Premier of Ontario to represent that province. While the Ontario appointee supervises the inspection of machinery, elevators and boilers, etc., in public buildings, what will he do when the technical points are brought up in connection with boilers, or in regard to engineers' certificates? Does the Premier realize that almost every article of the proposed act refers to the engineer and engineers' certificates? Fourteen articles (25 to 39) deal exclusively with engineers' certificates. The proposed act will change completely the Ontario Stationary Engineers' Act, and yet the department and the Board of Stationary Engineers, under whose supervision the proposed changes will come, have been "side-tracked." This is not meant to deal with Ontario's appointee. It would be a good thing to have him in attendance, but if Ontario's Government is sincere (and no doubt it is) it is evident that legislation will be greatly facilitated by sending the one who is acquainted with the situation.

The Canadian Association of Stationary Engineers, the London Board of Trade, etc., sent resolutions to the Ontario Stationary Engineers' Board regarding this proposed legislation, and the Ontario Government is making the interest of these institutions in this important measure of no effect.

The editor of The Power House interviewed the chairman of the Engine and Boiler section of the C.M.A., and he is of the opinion that the department, who have to deal with the legislation, shonld be represented. Every Ontario engineer in charge of a steam plant of 50 h.p. will be affected by the proposed new act, and the interests of this body of men should be consulted in the appointing of a representative.

The engineers feel the slight keenly and at a meeting held by the Toronto Lodge, Nov. 5. a committee of five was appointed to look into the question and have the engineers represented at the conference.

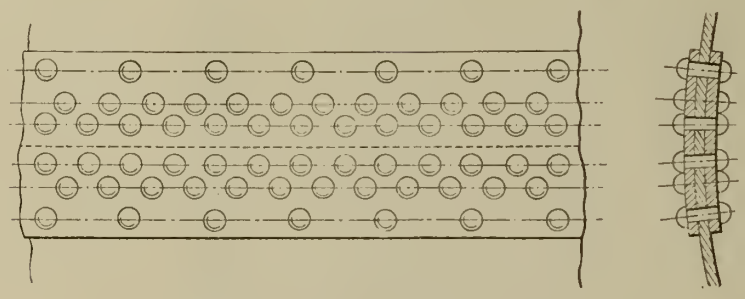
The education and experience of Mr. McGhie, chairman of the Board of Stationary Engineers, has amply qualified him to deal with the situation. He knows the boiler business in the factory and engine room, besides being in close touch with the engineers of Ontario. The proposed legislation should be assisted in every way by the Provincial Governments, and Ontario, by appointing the chairman of the board, will do this and receive the commendations of manufacturers and engineers alike.

## BEST FORM OF LONGITUDINAL JOINT FOR BOILERS.*

By F. W. Dean.

It has been generally accepted in the United States for a number of years that the best form of butted longitudinal riveted joint for boilers is that in which the inside strap is wider than the outside, and has one or more rows of rivets which pass through the shell and the inside strap beyond each edge of the outside strap. The pitch of the first row of outer rivets is double that of the rows that pass through both straps, and if there are other outer rows they may or may not have a still greater pitch.

In England where until comparatively recently boiler construction has been superior to ours, this form of joint appears to receive no recognition. It was first devised, as far as I know, by Dr. E. D. Leavitt, past-president of the society, and Edward Kendall, both of Cambridge, Mass., and was first used by Mr. Leavitt in some locomotive-type boilers designed by him for the Calumet & Hecla Mining Co. I have a blueprint of this boiler dated 1879. It is, of course, hazardous to state that this joint was never used before and it is quite possible that it was used in England, discarded and forgotten as poor construction, as I believe it is. It was first used on an American locomotive by the Baldwin Locomotive Works in a consolidation locomotive built by them for the Calumet & Hecla Mining Co., the drawing of this joint having been made by me when I was in Mr. Leavitt's employ.



Recommended Form of Longitudinal Joint.

While every boilermaker has for years been familiar with butt joints, this form made slow progress toward adoption in the United States. One form of joint, used to avoid the butt joint and get something as good, was a lap joint with an inside strap bent at the edge of the lap and riveted on each side of it. This was used on locomotives exclusively and was of little or no value, as it was simply a somewhat elastic bent tie connecting the two parts of the shell plate. Finally, and fortunately, this joint gave way to the butt joint first described.

I believe there has been no case of an explosion of a butt-joint boiler; at least one due to rupture of the joint. Recently, however, a boiler at Woonsocket, R. I., narrowly escaped explosion, a longitudinal rupture of the plate on one side of the joint, and within its limits, being discovered while the boiler was subjected to steam pressure. The steam pressure was rapidly reduced and no explosion occurred. The joint is in possession of the boiler-inspection department of the Massachusetts district police at the State House in Boston.

It has been growing upon me for some years that a one-sided boiler joint, such as that first described, is poor construction, and may sooner or later cause a crack in the plate. The Woonsocket phenomenon has tended to confirm this opinion. It is evident that unless the outside rivets fill the holes they do very little good, and when they do fill them they form an overhung connection and to some extent possess in themselves the now recognized defect of the lap joint. Moreover the extended inside plate forms a bent connection between the different rivets at different distances from the centre line of the joint.

In many cases designers have placed the outside rivets at a considerable distance from the edge of the outside strap and this is constantly overdone. It is obvious, on careful thought, that the outside rivets should be as near the edge of the outside strap as practicable, thereby diminishing the bent-tie effect. In order to diminish this effect still further, and also to render the overhung rivets more effective, the inside strap should be thicker than usual, and this feature can hardly be overdone. The inside strap should be at least as thick as the shell plate, and great care should be taken to have the holes match and the rivets fill the holes.

When a joint of this kind is tested to destruction in a testing machine, it will be found to fail somewhat in detail, the inside strap bending slightly and the outside rivets being the last to rupture after yielding a little. In a boiler the joint would be weaker than a flat specimen on account of the bent-tie feature. This could be prevented if it were practible to caulk the inside strap, as it would thereby be compelled to maintain the circular form. The theoretical efficiency of this joint is greater than of any other kind, but in practice I believe the efficiency is not realized and the defects that I have described render the joint, in my opinion, undesirable.

In order to avoid the defects of the one-sided butt joint, I have adopted and intend to use hereafter, a joint with both straps of the same width, as illustrated in the accompanying sketch. This has the merit of having all rivets in double shear and the strains all taken care of in the best manner. The efficiency of this joint can hardly be above 84 or 85 per cent., while that of the one-sided joint can be theoretically 91 or 92 per cent., but the certainty that the efficiency of the former is realized in practice is ample compensation for the use of slightly thicker plates. The pitch of the outer row of rivets is rather great, compelling the use of a thick outside strap in order to stand caulking and remain steam-tight. I use an equally thick inside strap in order to diminish the bent-tie-effect. This effect is small, however, as the rivets are all near the centre of the joint. It can be eliminated by caulking the inside strap, which is practicable with this joint, and is done in the best marine practice. This assumes that the caulking is effective and remains so.

* Presented at a meeting of the American Society of Mechanical Engineers.

## WIND-ELECTRIC POWER.

An interesting demonstration was recently given in England of an electric-generating plant operated by a windmill. The wind wheel was 16 feet in diameter, and was mounted on a tower 50 feet high. Three tails were provided, one at the side being fixed, and the other two adapted to be rotated on a horizontal axis, so that when they were turned into the vertical plane they would hold the wheel into the wind, and when turned in the horizontal plane, the fixed tail would throw the plane of the wheel in the plane of the wind. The two movable tails were arranged to swing out of the vertical position, automatically, when the velocity of the wind rose above a certain amount. A 2-kilowatt generator was driven by the wheel at speeds varying from 800 to 1,600 revolutions per minute. Six switches were provided to control the field circuit by throwing in a resistance when the current generated reached 5, 8, 11, 14, 17 and 20 amperes respectively. The current was used to charge a storage battery, which could be drawn upon as required for operating various electrical apparatus.—The Roller Mill.

# Mechanical Refrigeration and Its Principles

The fundamental principles of mechanical refrigerating machines are practically the same as those in all refrigeration, whether natural or artificial. To the scientist there is no such thing as cold. It is merely the absence of heat from certain bodies, and heat is nothing but a form of energy involved in the motion of the molecules. Thus a body gets cold if this motion is in any way taken away from the particles of the body. The body gets hot in turn if the amount of motion is increased, and its temperature is in direct proportion to the amount of motion or energy put into the substance. The unit by which this amount of energy is measured is called the British thermal unit, and is defined as the amount of heat or energy required to raise one pound of water one degree Fahrenheit.

With this fundamental conception of heat, and the further fundamental law, common throughout the universe, that all bodies tend to arrive at a common temperature by transfer of heat from the hotter to the colder body, the principles of refrigeration in all its phases, either artificial or natural, can be readily understood. On a cold day the heat tends to pass out of a body of water into the atmosphere and surrounding bodies in order to equalize temperature. It does this quite readily and rapidly until the temperature of freezing is reached. Then if the surrounding bodies are still colder than the water, it continues to give out heat or energy in order to produce an equalization of temperature until this is attained. But in case of water 142 times as much heat must leave the water at freezing point before it will get even a fraction of a degree colder.

On a cold day a pan of water will thus freeze up and the ice continue to get colder until a common temperature is reached. In turn, when this material is heated up by warmer surrounding bodies, it absorbs heat or energy from them until an equalization of temperature occurs, and it in turn cools them off, due to the removal of heat or energy from them. The particular advantage of ice in preference to cold water as a refrigerating agent is due to the large quantities of heat, which are absorbed during the so-called change of state from ice to water. This is equivalent to a change in temperature of 142 degrees in the water. Cold water could be used, and in places where a supply of artesian water is available at a cold temperature throughout the summer months, this latter can be readily piped throughout a building and used for refrigerating purposes on account of the transfer of heat to it from surrounding bodies.

### The Naturalness of Mechanical Refrigeration.

This briefly explains the principles of natural refrigeration. Ice is not necessary for this purpose. It is merely the most convenient and satisfactory agent at hand under normal conditions. Mechanical refrigeration is not a mechanical process; it is as much a natural process of refrigeration as that from melting ice. Any solid, with a few exceptions, absorbs heat in melting, and if it is at the temperature of surrounding bodies, and made to melt, it will automatically cool off and absorb heat from surrounding bodies by induction, producing refrigeration in them. The method of mixing ice and salt for the purpose of low temperatures in ice cream manufacture is an illustration of the possibilities in this development. The salt makes the ice melt, no matter how cold it becomes, down to 40 degrees below zero, and it absorbs heat, due to the melting of the ice, from bodies immediately in contact, clear down to this temperature. Not only is this change of state from a solid to a liquid utilizable for this purpose, but the change from a liquid to a gas is equally capable of application here.

Water absorbs large quantities of heat in changing into steam, as is apparent from a consideration of the long time required to boil water away after it reaches the boiling point. In turn, steam will give out large quantities of heat to surrounding bodies when changed to water, or if this latter result is attained by pressure alone, water can be made hotter and hotter. The quantities of heat involved in change of state from a liquid to a gas are generally several times that involved in the change from a solid to a liquid, and water changing to steam will absorb 1,000 British thermal units without change in temperature, or if used as a cooling agent will absorb as much heat as 1,000 pounds of water will do when heated one degree. The boiling point of water, however, is so high that, while it will produce refrigeration and cool off hotter bodies, is unsatisfactory for ordinary refrigerating processes.

Liquid ammonia is the next best known substance, and has a boiling point, in the atmosphere, of about 26 degrees below zero, absorbing large quantities of heat, the amount of which, however, is dependent upon the temperature at which the ammonia is allowed to boil away, this later being dependent upon the pressure maintained in the gas or vapor above the ammonia, and being identical in character, if not in amount, with changes in the boiling point of water with pressure. Thus the pressure in an ice-making machine is from 15 to 20 pounds above the atmosphere on the suction side of the cooling coils, and the temperature of the boiling ammonia is from 16 degrees to 18 degrees Fahr.

The temperature can be readily lowered in the cooling coils by reducing the pressure, since the boiling point falls as well. A supply of liquid ammonia is all that is necessary to produce very satisfactory refrigeration, and no machinery whatever is required in this development. The price of liquid ammonia, however, is such that this agent, used this way, is prohibitive, and the necessity of caring for the fumes and not allowing them to become a nuisance in the neighborhood, is equally apparent. Thus ammonia is the best refrigerating agent known, and produces refrigeration automatically by change from a liquid to a gas, which process occurs spontaneously on release of the pressure above the ammonia. The machinery used in a refrigerating plant is for the sole purpose of recovering the liquid ammonia, so that it can be used over and over again with small loss due to leakage. The regeneration principle is based on the variation of the boiling point with pressure. Thus ammonia gas at a normal temperature of surraounding bodies, if compressed to about 180 pounds, will spontaneously condense and

give out its heat, since the boiling point at this pressure is above that of surrounding bodies. If the pressure is then lowered, it will evaporate and absorb heat.

The same amount of ammonia must be condensed as is evaporated, and generally the heat given out through condensation is equivalent to the heat taken in in evaporation. Thus many engineers regard a refrigerating machine in the light of a heat pump, all the heat absorbed during evaporation being necessarily dumped out at a higher temperature during condensation. In actual practice the condensation is accomplished by allowing ordinary cold water, or even fairly warm water, available from the city mains, to flow over a bank of pipes known as the condenser, in which the ammonia gas is maintained under pressure by means of a compressor. The heat leaves the system at this point and enters from the cold storage room or refrigerating chamber through the refrigerating coil, which is a bank of pipes in which the ammonia is allowed to evaporate at a lower pressure, the fumes being sucked out of the system by the compressor, so that the pressure will not rise.

A refrigerating plant, therefore, consists of ammonia compressor, a condenser and a set of refrigerating pipes with a regulating valve between the condenser and the refrigerating coils. This is the type that is generally advisable to install in all confectionery plants, unless they are of excessive size or have large quantities of exhaust steam available. The only requirement in the steam is the production of pressure in the ammonia gas, and this is accomplished by mechanical compression. The absorption machine produces the pressure by a device analogous to that used in the production of pressure in the steam boiler, and utilizes the absorptive power of water for ammonia gas at low temperatures, and the loss of this power with rising temperature to produce the pure case under a condensing pressure. The process, while in some cases more efficient than the compression type, is undoubtedly more complicated, and involves the substitution of considerable machinery and various devices to produce the same result as is attained by a simple mechanical compressor compressing the ammonia gas to the required pressure. The choice between these two types is largely a matter of relative efficiency from a first cost and full consumption viewpoint, but in a general way it can be said that only in extreme or abnormal cases should the absorption system be used. The great majority of objections to the compression type, from an efficiency standpoint lose their effectiveness in confectionery application, since only mild refrigeration is required, a temperature of 60 degrees to 65 degrees being as low as is necessary for the proper manufacture and preservation of the confectionery products.

## COST OF WATER POWER PLANT.

The accompanying table of estimated costs per horse power of water power plants was prepared by Charles T. Main, mill engineer and architect, Boston, Mass., and gives approximate figures for ordinary conditions and should be useful in making rough preliminary estimates.

Inglis Engine for Kew Beach Sewage System, Toronto.

It is to be noted that the costs of dam, canal, and buildings are not included, for these of necessity will vary greatly with the locality.

TABLE OF ESTIMATED COST PER HORSE-POWER OF WATER POWER PLANTS.

Having Horizontal Turbines, Steel Penstocks, and Walled Tailraces—Dam and Buildings not included.

| | | "L." | | 10 ft. fall | 20 ft. fall | 30 ft. fall | 40 ft. fall |
|---|---|---|---|---|---|---|---|
| | | 200 | feet | $71.91 | $32.84 | $21.70 | $16.38 |
| 1,000 | h.p. | 400 | " | 85.43 | 39.77 | 26.32 | 19.35 |
| | | 600 | " | 93.96 | 46.69 | 30.94 | 23.53 |
| | | 200 | " | 72.22 | 33.12 | 21.98 | 16.78 |
| 800 | h.p. | 400 | " | 85.70 | 40.04 | 26.56 | 20.35 |
| | | 600 | " | 99.15 | 46.98 | 31.17 | 23.93 |
| | | 200 | " | 72.64 | 33.49 | 22.34 | 17.20 |
| 600 | h.p. | 400 | " | 86.20 | 40.45 | 26.95 | 20.87 |
| | | 600 | " | 99.76 | 47.42 | 31.57 | 24.54 |
| | | 200 | " | 73.16 | 34.05 | 23.10 | 17.82 |
| 400 | h.p. | 400 | " | 86.90 | 41.03 | 27.73 | 21.45 |
| | | 600 | " | 100.65 | 48.03 | 32.35 | 25.08 |
| | | 200 | " | 75.35 | 35.97 | 24.97 | 19.47 |
| 200 | h.p. | 400 | " | 89.10 | 43.56 | 29.70 | 23.21 |
| | | 600 | " | 102.85 | 50.60 | 34.43 | 26.95 |

## CORLISS ENGINE FOR KEW BEACH SEWAGE SYSTEM AT TORONTO.

The Corliss engine shown in the accompanying illustration, is being constructed in the works of John Inglis & Son, Toronto, for the Kew Beach filtration beds, Toronto. It is a compound engine with the high and low-pressure pistons on one piston rod. The cylinders are 12 in. and 24 in. by 30-in. stroke. A receiver connects the two cylinders.

The drainage area is 185 acres. The sewage is pumped from station No. 1 to the high-level sewer, from which it gravitates to pumping station No. 2. These pumping stations are built of concrete, are circular in plan, with a partition wall in the centre, with a reservoir space of 3,200 gallons, each containing a duplicate set of pumps and motors. In No. 1 are two 5 h.p. a.c. vert. motors, and two 4-in. submerged centrifugal pumps. In No. 2 are two 7 h.p., a.c. vert. motors and two 4-in. submerged centrifugal pumps. Motors and pumps are automatically controlled by rise and fall of sewage in the reservoir. The pumps are direct connected to the motors.

---

The contract for what is believed to be the largest generators in the world, has recently been awarded to the General Electric Manufacturing Co., of Sweden. The five generators are to be supplied for the Rjukan Saltpeter Plants in Norway, and are each of 23,000 electrical h.p., 11,000 volt, 50 cycles, 250 r.p.m., of the horizontal water-wheel type, totally enclosed and ventilated by the revolving field, which acts as a fan. Canadian representatives are Kilmer, Pullen & Burnham, Toronto.

# Venturi Meter for Hot Water Work and Boiler Feed

## Venturi Meter built of Material that Withstands Corrosion—Makes a Reliable Hot Water Meter— Test of a Boiler Feed Venturi Meter.

By PROF. C. M. ALLEN *

A reliable and accurate hot-water meter has been in demand for a good many years. The principle of most of the cold-water meters, where there are moving parts in the water, is not at all adaptable for hot-water work. A hot-water meter for boiler-feed purposes must stand not only the variation in temperature but also considerable variation in pressure, and quite often it has to stand a certain amount of water-hammer, this depending somewhat upon the style and condition of pump used. The Venturi meter, having no moving parts to get out of order and being of material which will stand the ordinary corrosive effects, should make a reliable hot-water meter.

The object of these tests was to determine the accuracy of a Venturi meter to be used for measuring boiler feed under a great variety of conditions. The plan was to make a complete series of tests upon a small Venturi meter under all the probable conditions that would ever be met in boiler room practice. The tests were made under varying temperatures and velocities ; under varying pressures, intermittent and steady ; using a triplex power pump in good condition, and with one plunger out of commission, a duplex steam pump in good condition and in poor condition, and an injector.

The meter was installed in the steam engineering laboratory of the Worcester Polytechnic Institute and set up the way most convenient not only for weighing the water passing through the meter, but also for heating the water before it went through the meter, and pumping it in in various ways. The meter used was built by the Builders' Iron Foundry of Providence, R.I., and is what is ordinarily called a 2-in. meter, the upstream and downstream ends being 2-in. in diameter and the throat $\frac{3}{4}$ in. in diameter. The main part of the meter is of cast iron and the internal portions are lined with brass. Surrounding the upstream end and throat are annular chambers between the brass sleeve and the iron casing. Six holes are drilled through the brass lining into these annular chambers at about equal distances around the circumference, in order to give the actual pressure heads in the meter at both throat and upstream end. From the outside of these annular chambers were pipe connections to a manometer tube which consisted of a glass U-tube containing mercury. There were the necessary valves and pet-cocks to manipulate the meter, blowing out the air whenever it accumulated. The general layout of the apparatus is shown in Fig. 1.

The apparatus was set up so that the meter could be supplied from a $1\frac{1}{2}$-in. metropolitan injector, a $4\frac{1}{2}$-in. by $2\frac{3}{4}$-in. by 4-in. duplex pump or 4-in. by $5\frac{3}{4}$-in. triplex power pump ; or from a pressure tank supplied from the city mains or by a large duplex pump. These pumps were arranged to take their suction from a pit 12 ft. long, 6 ft. wide and 4 ft. deep, directly beneath the Venturi meter. A 1-in. steam line was put in to heat the water. There being about 300 cu. ft. in the supply pit, a very even temperature could be maintained. In order to keep the discharge from the pumps constant, a suction well was supplied, kept at constant level by an additional pump from the main pit. The discharge from all the pumps used was carried up a vertical 2-in. pipe, at the top of which was an air chamber 4-in. in diameter and 3 ft. long, with a valve so inserted that it might be cut out whenever desired. From this vertical pipe ran a line containing the Venturi meter, a thermometer-well for determining temperatures, and a valve for throttling water in order to get any desired pressure. At the end of this line was a swinging end that discharged into either of two 5,000-lb. weighing tanks.

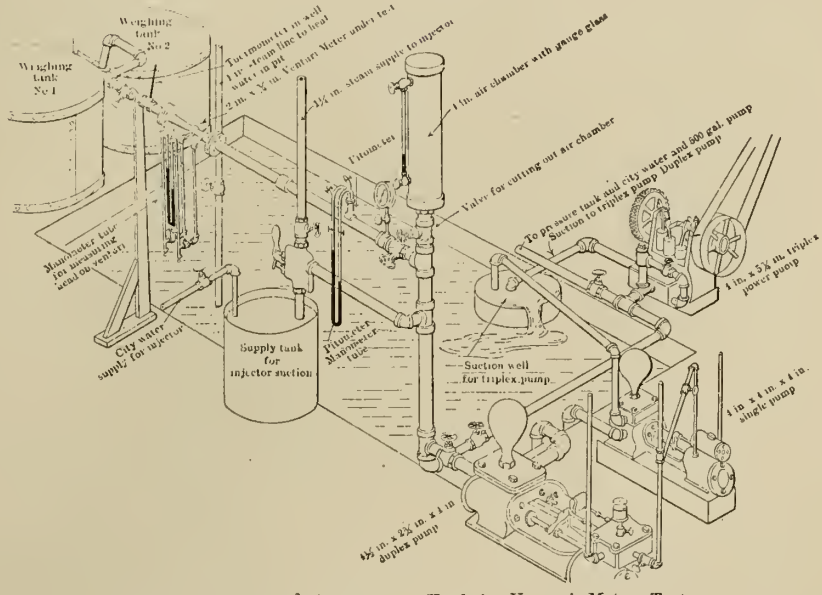

Weighing tank No. 2
Weighing tank No. 1
1½ in. steam supply to injector
1 in. air chamber with gauge glass
Valve for cutting out air chamber
To pressure tank and city water and 600 gal. pump
Suction to triplex pump Duplex pump
4 in. x 3¾ in. triplex power pump
Manometer tube for measuring head on venturi
City water supply for injector
Supply tank for injector suction
Piezometer Manometer tube
Suction well for triplex pump
1 in. x 4 in. x 4 in. single pump
4½ in. x 2¾ in. x 4 in. duplex pump

Fig. 1.—Layout of Apparatus Used in Venturi Meter Tests.

The first tests were made with cold water in order to determine the coefficient. These were made with steady pressure, securing a very constant flow. Water was run through the meter until the conditions had become constant. One tank was weighed while the water was being discharged into the other. The tests were started by diverting the discharge into the weighing tank and taking the time. Readings of the Venturi meter were taken every thirty seconds for low velocities and every minute for higher. The tests were ended by diverting the discharge into the other tank, taking the time and weighing.

When hot water tests were made, it was found that a certain amount of water evaporated ; evaporation tests were therefore made, which proved this amount to be a negligible quantity.

In order to compare the workings of the meter under the various conditions, it was decided to determine the coefficients for this meter under these conditions. The discharge of the Venturi meter was figured from the regular formula, using a coefficient of one, and the actual weight obtained from the weighing tanks was divided by this value to obtain the real coefficient.

The following temperatures were used during the tests : 80 deg., 120 deg., 140 deg., and 180 deg. fahr. Water for these tests was supplied by the triplex power pump with different velocities through the meter. Tests were made at 140 deg. with and without the air chamber, the water being furnished by the triplex power pump ; then at 140 deg. with one plunger of the triplex pump disconnected so as to produce fluctuations in the velocity and pressure of the water supplied to the meter.

* Read before the American Society of Mechanical Engineers.

In order to duplicate more nearly the conditions of boiler feed, an air chamber and check valve were placed in the pipe line in the downstream side of the Venturia meter (not shown in Fig. 1). Because of the air chamber at this end the pump fluctuations could pass through the meter to a much more marked degree than if the discharge was merely throttled by a valve. Under these conditions tests were run with water supplied by the injector, taking suction from a special supply tank; with the injector, however, the temperature of the water of necessity varied with the velocity through the meter.

### Conclusions.

The chief difficulty encountered in making this series of tests was in getting the true average readings of the manometer. With the higher velocities through the meter, the fluctuations could be easily dampened by closing the valves to the manometer tube, but with the lower velocities any error in reading was so large in proportion to the entire head as to make a considerable difference in results. It may be said, then, that the meter is not accurate for velocities of less than 10 ft. per sec. in the throat of the meter, which corresponds to a discharge of 0.03 cu. ft. per sec., or about 6110 lb. per hour, so that this meter would be best adapted for measuring water for a boiler plant of above 200 h.p. The coefficients are materially lower below 0.03 cu. ft. per sec. The principal feature shown by the cooler water tests (80 deg. fahr.) is the low value of the coefficients of the meter, the average, excepting the values for velocities below 10 ft. per sec., being 0.942. This coefficient might have been expected, however, as in a small meter the ratio of area of cross section to surface is much lower.

These experiments clearly show that the meter is as accurate for hot water as for cold. The maximum error in discharge, as figured from manometer deflections using the mean coefficients for that temperature, is as follows: 80 deg., 1.39 per cent.; 120 deg., 1.5 per cent.; 140 deg., 1.9 per cent.; 180 deg., 0.82 per cent. The average error is well within 1 per cent.

Of the pumps tried with the meter, the triplex gave by far the best results, and it may be confidently stated that the Venturi feed-water meter would give very satisfactory results in a plant using the power pump. Even with one plunger disconnected, the maximum variation was only 2.4 per cent.

In tests with the injector, the weighed calculation from Venturi formula, using the mean coefficient, shows variations from actual weigh of 3 per cent. The average error is inside 2 per cent.

The results from 4½ in. by 2¾ in. by 4 in. duplex pump show up better than might be expected as this pump was in very poor condition, the piston rods being so worn that the pump took air through the stuffing boxes at the water end.

These tests represent the worst conditions which would be met with in boiler feed. The pump would start building up pressure, then pause until the pressure had fallen. The check valve which was located only about 6 in. downstream of the Venturi meter, was opening and closing constantly. For a discharge of more than 0.03 to 0.04 cu. ft. per sec., the coefficients were very consistent.

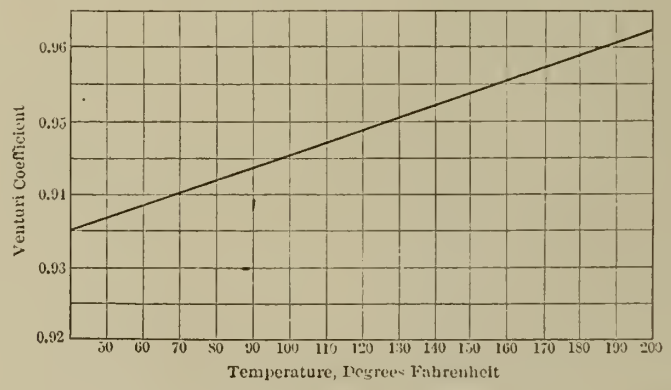



Fig. 2.—Curve Showing Variation of Venturi Coefficient with Rise in Temperature.

It must be remembered in considering these tests that the Venturi meter itself probably worked more accurately than the tests would indicate, as every change in velocity through the meter is accompanied by its corresponding change in head on throat and up-stream end, and that a continuous recording device attached to the meter would probably cut down the error considerably. It is the opinion of the experimenters that the Venturi meter is a very reliable form of hot-water meter, provided the proper size is used.

These tests were conducted for the most part by George Y. Lancaster, a post-graduate student in mechanical engineering at Worcester Polytechnic Institute, and these results are taken from a thesis submitted by him.

## B. C. ELECTRIC WORK IN VANCOUVER.

The following are the particulars of the work and extensions of the British Columbia Electric Railway Co. in Vancouver since the execution of the agreement between that city and the company in 1900:

The Lake Buntzen water power development, necessary for the securing of additional power to handle the increased area of operation. This work cost $2,000,000.

The North Vancouver service, amounting to five miles in that flourishing young city opposite Vancouver on the north shore of Burrard Inlet. This cost $250,000.

The Lulu Island Railway and the Eburne and Westminster connection, opening up a fine agricultural section. The total cost of these two was $300,000.

Instalation of light and power system at Ladners. This cost $50,000.

Double-tracking and relocating on the New Westminster line, some twelve miles in all. Cost, $500,000.

The Chilliwack line, 63 miles in length and traversing a magnificent agricultural country. This line, which is still under construction, has now reached Cloverdale, and will be at Abbotsford before the end of the year. The cost is $2,000,000.

South Vancouver tramways extension from five to six miles. Cost, $100,000.

Burnaby tramway extension, about five miles. This cost $100,000.

Hastings tramway extension, about five miles. This cost $100,000.

In addition to this, there is the items of new trackage, contained within the city limits of Vancouver itself, and which amounts to $500,000.

Here, then, is the enormous total of $5,950,800 expended in opening up and providing with adequate transportation facilities the city of Vancouver and the country directly tributary to it. And this large sum has been expended by the British Columbia Electric Railway Company in the short space of a little more than eight years which has elapsed since the agreement between the city and the company was entered into in 1900.

The greater part of this five million dollars was absorbed by labor. This was a direct benefit to the city of Vancouver. The increase in population was correspondingly great, while the augmentation of property values is almost beyond computation. There is no question that the extension of the tramway system has been one of the chief agencies in the growth of Vancouver. Why should we in Victoria, from motives which will not endure before reason, oppose its expansion in this city and neighborhood?

# Crude Rubber: Its Varied Manufactured Products

By G. C. KEITH, B.Sc.

When the demand for automobiles made the prices of crude rubber ascend until it is three times the price of ten years ago, those not familiar with the reason, asked, "What connection is there between automobiles, and rubber belting, gaskets, packing, steam hose, etc?" The number of automobiles in use this year in America alone is 184,000, with an output this year of 82,000. This number will probably be doubled next year. For these automobiles, as well as bicycle tires, rubbers, hose, etc., crude rubber is required. It is the demand for automobiles, however, that is chiefly responsible for the present high prices.

Prices of crude rubber have been receiving considerable attention lately on account of the effect upon the cost of mechanical rubber goods used for power development and transmission. When an engineer uses a rubber belting, or he uses rubber packing, it may not occur to him the processes through which the rubber goes from the time it leaves the forests of Brazil until it reaches his power plant in the shape of packing.

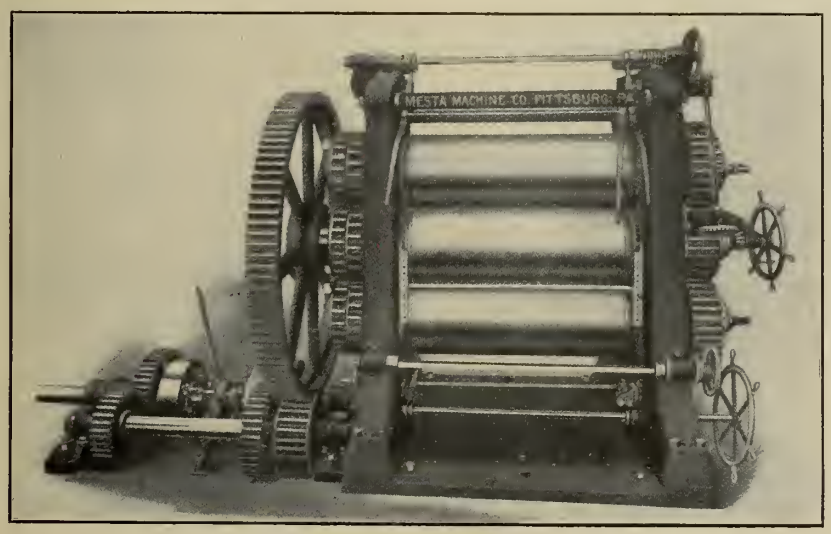



Fig. 1.—Mesta Machine Company Three Roll Calendar.

A large percentage of the rubber used in the world is found in the forests of Brazil. The demand has made it necessary to cut further and further into the interior, until the cost of transportation has been largely increased. Shipping is done chiefly at Para and Manoas, on the Amazon river, Brazil. Para rubber is the standard, it being the most expensive and highest grade of crude rubber. There are about seventy-five or eighty other grades, for the most part poor, which are found on other continents.

### Crude Rubber.

The latex or milk is obtained from the forests of Brazil, and many trees, shrubs and vines of hot countries. Rubber is a hydrocarbide of a vegetable nature resembling the "milk" of milkweed. The principal commercial supply from the valleys of the Amazon, Orinoco, (Brazil, Guiana and Venezuela) is chiefly the product of a tree often 60 feet in height, branching from the base, which, with two or three similar species, grows abundantly in the hot, steaming lowlands along the river courses; the juice is obtained by tapping the trees, by means of incisions in the bark in the evening, and collecting the deposition next morning. Each tree will yield about two ounces per day, and after three days must be allowed to rest.

The rubber obtained in South America differs from the Asiatic and African rubber. The Asiatic supply is chiefly produced by the rubber-fig. The trees may be tapped when 25 years old and for fifty years afterwards will yield 40 pounds of caoutchoue (native name for rubber) every three years. A large variety of trees and plants yield rubber in the Malayan region, some of which is excellent and of growing importance commercially. More than 100 trees are known to give rubber-making juices in commercial quantities, while it also exists in small quantities in the poppy, milkweed, lettuce, etc. The juice of the Brazilian trees is said to yield about 30 per cent. pure rubber, but less than 15 per cent. is not commercially profitable. Next to Brazil, Africa is the principal source of the world's rubber supply.

In preparing rubber for shipment a fire of uri curi nuts is made, over which is placed an earthern vessel with no bottom, so that the smoke ascends through it. The native takes a wooden paddle, dips it into the vessel containing the milk, and immediately holds it in the smoke, revolving the paddle slowly with the hands. The milk is coagulated by the smoke. When he judges that the coagulation is complete, he again dips the paddle into the milk and repeats the process. The rubber forms what is known as a biscuit, and weighs from 7 to 200 pounds.

The natives carry the biscuits to a camp, where a man runs the camp and has charge of both the natives and their work. The rubber is then loaded on boats and carried to Para and Manoas, where the biscuits are cut open and inspected. There are three grades of Para rubber—fine, medium and coarse—depending on whether the rubber has been properly treated, etc.

Attempts have been made in most countries, where suitable conditions prevail, to propagate the rubber trees in plantations, capable of rational supervision by experts, assuring annual crops of good quality for an indefiinite number of years. It has been demonstrated that trees, properly cared for, will give an increasing crop each year without injury. The Mexican Government and capitalists are meeting with success in the cultivation of rubber trees. The trees are raised from seeds in nurseries, planted when about one foot high, and when six years old, the first crop is taken from them.

### Process Through Factory.

The rubber is received in the factory in the biscuit form referred to above. It is placed in the mill, which has two revolving rolls, both revolving inwardly.

The rolls are corrugated and all dirt is washed away, a spray of water from above playing on the rolls. The rubber is then pressed into a sheet by running it through smooth rolls. It is then dried in a drying room, being suspended on wooden bars, a fan keeping up a continuous blast of air. The moisture is removed in about two weeks.

Sulphur is added to the crude rubber and it is then passed through a mixing mill, which are rolls fitted with steam pipes. By passing the rubber through and through for twenty or twenty-five minutes, adding sulphur and oxide of lead (to make rubber more dense) the operator obtains a uniform product. It is then transferred to a calendar, one of which, manufactured by Mesta Machine Co., Pittsburg, is shown in Fig. 1.

The rolls are cast solid, bored and chambered, thus assuring an even temperature at the surface of the roll. Heavy section box type frame is used, doweled and securely bolted to a heavy bed-plate and held at the top by tie pieces. The complete equipment furnished with calender includes guides, blister roll with bearing and slides, one geared friction take-up, friction brake, either band or disc type.

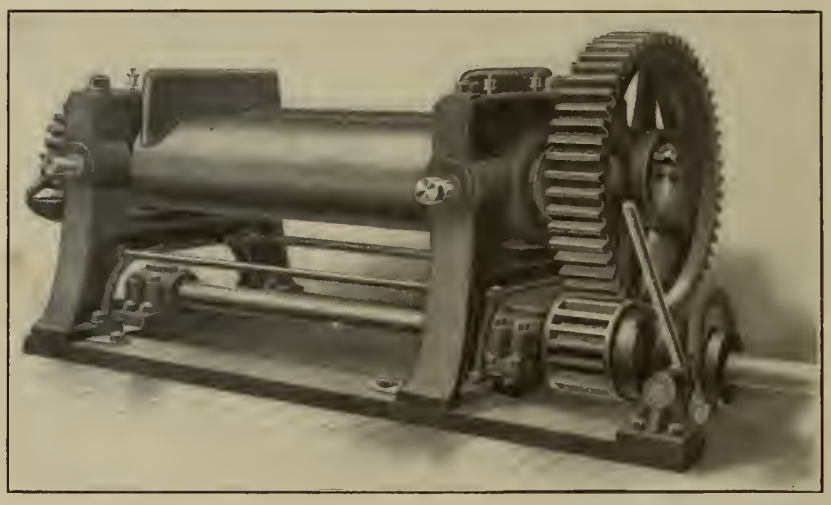


Fig. 2.—20 inch Grinder and Mixer, Mesta Machine Co.

Fig. 2 is a Mesta grinder and mixer. The hollow rolls used are either water chilled or vanadium dry sand, according to surface desired. Both methods of roll manufacture produce a very strong roll, thus permitting the use of a thin shell, making it easy to keep the rolls at the proper working temperature. Machine is fitted with automatic or common guides, slush pan for roll-connecting gears, necessary drip troughs for journal boxes, jaw clutch and pinion for connection to main drive shaft, and heavy bed designed to suit any location of shaft.

This process is then followed by a vulcanizing process, carried on at a high temperature.

There are several large Canadian factories where great quantities of mechanical rubber goods are produced. They are all working to their capacity producing goods for the market and consuming a large quantity of rubber. Until some other material is discovered, that can be substituted for rubber, or until some organized method of cultivating rubber-producing trees is undertaken, the present high prices must be maintained.

**Comment on Rubber Situation.**

Consul General George E. Anderson, writing from Rio de Janeiro, under date of September 3, says that the movement of Brazilian rubber at the beginning of the present season of 1909-10 is under conditions which have had no parallel in the trade for many years, if ever before. Mr. Anderson discusses it as follows:

The chief element in the situation which is likely not only to lead to lower prices, but also is reasonably certain to bring about regularity in supplies, and therefore a more permanent price range, is the plantation rubber supply. The supply of rubber plantations in the Far East during the current year is placed at 4,000 tons by practically all authorities. The actual present acreage in rubber plantations in the East at present is placed at from 520,000 to 600,000 acres. The rubber production from such plantations, as they come into bearing, is placed generally at about one ton of rubber to ten acres of plantation. The immediate supply from such source—a supply to be fully realized in the course of three or four seasons—will unquestionably reach from 60,000 to 70,000 tons, or substantially the equivalent of the present world supply.

If the demand for rubber increases at the present rate the world ought to be consuming in, say, 1914 about 105,000 tons. What the total world production will be at that time is of course problematical, but it looks as though plantations would be producing more than enough to supply the world market. Such supply will be reasonably regular, will be based upon a known cost price, and it is quite evident that there will be no occasion for the immense variations in price which have characterized the rubber market for the past two years in a way to not only carry many losses to manufacturers, but also to embarrass them in manufacturing for a market even near at hand.

## TRAINING NAVAL ENGINEERS.

Arrangements are under way for the inauguration of a new course of lectures in the McGill Faculty of Applied Science course in harbor engineering.

The study which shall be obligatory on those who undertake it, will consist of twenty or twenty-five lectures on general harbor engineering, including the study of docks, dry docks, types of ports, port equipment, channel approaches and all other matters under harbor administration. Mr. F. W. Cowie, chief harbor engineer for the port of Montreal has been asked to take charge of the course, and it is probable that he may do so, beginning the course after the Christmas vacation. One lecture a week will probably be given and will be varied as far as is possible in the winter months with practical illustrations.

In view of the great development in ports which Canada may now reasonably expect from the institution of a Canadian navy and the growing expansion of her overseas trade, such a course may open up a large field to engineering students. It is evident that Canada at present has not a sufficient number of engineers skilled in harbor work, who could supply the demand which may be naturally expected; and this course may mean the engagement of many young Canadians for work which would otherwise have to be given to engineers brought from other countries for the purpose.

## EXPLOSIONS FROM MACHINE BELTS.

To show how great may be the generation of static electricity in German factories, Prof. M. M. Richter has drawn sparks an inch to an inch and a half long from a five-inch belt on a wheel making 10,000 revolutions a minute. The risk of explosion in dust or gases seems to have been overlooked. Coating with bronze or aluminum powder prevented static charges, while a weekly application of acid free glycerin was a remedy and added durability to the leather.

## INGLIS 15,000,000-GALLON PUMP AND ENGINE.

The growth of Toronto has necessitated the addition of some large pumps and engines to the pumping stations. The one illustrated in Fig. 1 is under construction at John Inglis & Sons, Toronto, and will be erected in the main pumping station, John Street. The contract for the pump was awarded in February, 1908, and it is expected that by February, 1910, the erection of the pump in the John Street station will be completed.

Fig. 1 shows the cylinders and bases of the engine and pump, with the base of the low-pressure cylinder removed in order to show the valve mechanism of the pump. When in place, the pump will be 52 feet in height. It is a direct-flow type, that is, the water always flows in one direction. The cylinders are 32, 60 and 90 in. in diameter, with a 60-in. stroke. The floor space covered is 16 feet by 32 feet.

The pump cylinders were cast in the foundry of John Bertram & Sons, Dundas. The low-pressure cylinder weighs twenty tons, and the others 22,810 lbs. and 19,320 lbs. The steel for the engine, including the crank shaft, was furnished by the Nova Scotia Steel & Coal Co.

The pump valve cages are shown in Fig. 2, and are 42 in number, each containing 28 brass pump valves, 3⅝ in. in diameter. The cages are made secure to separate, vertical cast steel valve decks.

The crank shaft in its finished condition weight 15 tons. It is 23 feet between the pins, is 17 in. in diameter at the bearings, and 19½ in. where the flywheels go on. The cranks are in two pieces, and pressed on at 200 lbs. pressure. The high and low crank pins are 8 in. diameter by 8 in. long, while the intermediate is 12 in. diameter, by 8 in. long.

The two flywheels each weigh 20 tons. They are 15 feet in diameter, 19½-in. bore and 14 in. face. They are made in halves, fastened together by steel rods, heated and allowed to cool.

Fig. 3 shows a large casting for the pump, made in the foundry of the Berg Machinery Co., as it appeared when taken from the mold. It and the other large pump connections were made under the direction of David Reid, superintendent of the Berg Machinery Co.

---

The Polson Iron Works, Toronto, manufacturers of the Heine safety water tube boiler, etc., have appointed Watson, Jack & Co., 709 Power building, Montreal, selling agents for the Province of Quebec.

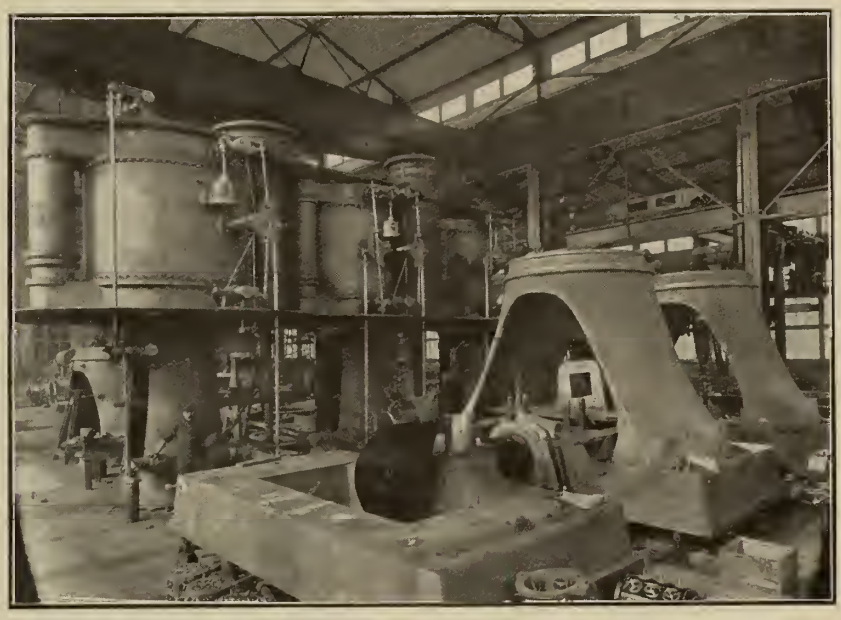


Fig. 1.—Inglis 15,000,000 Gal. Pump and Engine.

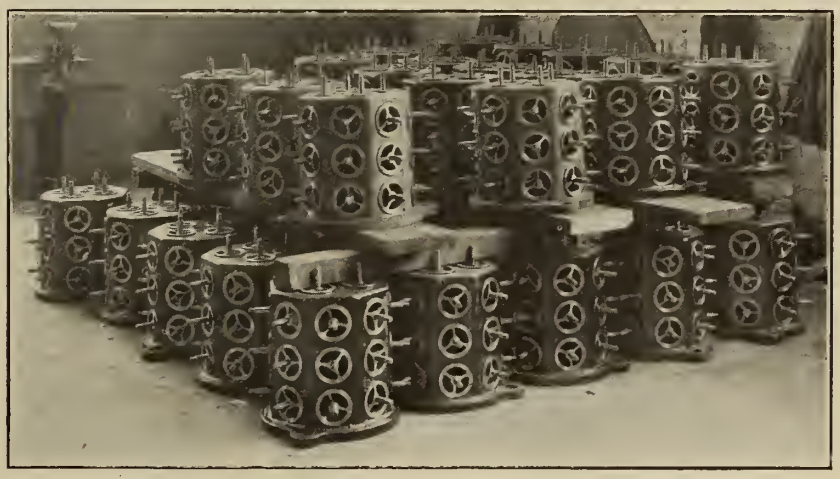


Fig. 2.—Forty-two Cages, Each Having 28 Valves, Inglis 15,000,000 Gal. Pump.

Fig. 3.—Large Casting for Intake, Inglis 15,000,000 Gal. Pump.

# Annual Social Gathering of Toronto No. 1 Lodge C.A.S.E.

## Twenty-second Annual Banquet held in Walker House, on Friday, October 29, 1909, was a Great Success in Points of Attendance and Enthusiasm.

THE twenty-second annual banquet of the Toronto Lodge of Stationary Engineers, marked another milestone in the success this lodge has had since its incorporation. The addresses were enthusiastic and instructive and a spirit of good fellowship was shown which resulted in everyone present having a most enjoyable evening.

The toast-master was W. C. Tait, president of Toronto No. 1 Lodge. Seated beside him at the head table were W. E. Archer, W. C. McGhie, Hon. Mr. Duff, Dr. Pakenham, J. J. Main, C. Moseley, G. C. Keith, Geo. Mooring, W. Ward, J. C. Armer, M. H. Kerr, D. Metcalfe, Controller Harrison, Commissioner Harris, A. M. Wickens, Ald. McGhie and F. Stubbs.

A banquet committee consisting of W. C. Tait, president; W. E. Archer, chairman; M. H. Kerr, secretary; Chas. Moseley, A. M. Wickens, Frank Stubbs, Jno. W. Marr, H. E. Terry, Thos. D. McGhie, J. G. Bain, A. H. Kirby, had charge of arrangements and an enticing supper was prepared, and excellent speeches were given.

### Menu.

Cotuit Cocktails
Eureka Celery Manzanilla Olives
Tomato Bouillon en Tasse, whipped cream
Salmon en Tranches a la Meuniere
Concombre en form
Timbales de Boeuf a la Rothchild
Glace a la Orange
Young Roxborough Turkey, stuffed, aux Cameberges.
Pommes de Terre au Fraintanes
Tomates Frites Haricot Vertes
Salade de Laitue, aux Oeufs
English Plum Pudding, Brandy Sauce
Bisque Tortoni Petit Fours
Fruits Assortis
Fancy Nuts Sultana Raisins
Fromage de Gorgonzola
Cafe Noir, Demi Tasse.

### The Toast List.

The King—Proposed by W. C. Tait and responded to by the guests rising and singing, "God Save the King."

Canada our Country—Proposed by Dr. Pakenham, dean of the faculty of education, University of Toronto, and responded to by Hon. Dr. Duff, minister of Agriculture, under whose department is the Board of Stationary Engineers.

Toronto, our Home—Proposed by J. J. Main, general manager of the Polson Iron Works and responded to by Controller Harrison and Ald. McGhie.

The Manufacturing Interests—Proposed by Commissioner Harris and responded to by J. J. Main.

Toast-Master, W. C. Tait.

The C. A. S. E.—Proposed by W. E. Archer and responded to by A. M. Wickens.

The Press—Proposed by Chas. Moseley and responded to by J. C. Armer,

Hon. Mr. Duff Tells of Canadian Greatness.

B. Sc., G. C. Keith, B. Sc., editor of The Power House, and A. W. Smith.

### The Speeches.

The speeches were instructive and received the attention of every engineer present. Dr. Pakenham in proposing the toast to "Canada, our Country," pointed out the important position an engineer had, being responsible for lives and property and for industrial activity and progress. He is the kingpin of industrial activity and is a stationary engineer because he stays "put." He stays "put" to place his profession on an educated basis. The engineer is not a rule of thumb man, he must think, he cannot be a "dub" but must be a scientifically trained and educated man.

The engineer should stay "put" in his determination to make the stationary engineer of Ontario a standard acceptable to British Columbia and all the other provinces. Canada requires trained workmen. The rapid uprising of chimneys, proves that. The present schools are not sufficient to supply these educated men and a new system is necessary. The educational department of Ontario has promised to consider the matter of technical education and is now considering the matter. The press, manufacturers and governments must all unite in making all the people coming to Canada efficient and useful Canadians.

Hon. Mr. Duff, in responding to the toast of "Canada, our Country," referred to the progress Canada has made in the past hundred years and how steel rails were being laid across the Dominion opening up untold wealth in Ontario and the provinces. Factories followed the railroads, developments were being made in every line and Canada, in agriculture, and in engineering, was showing wonderful progress.

"Toronto, our Home," was referred to as a city of homes, by J. J. Main in proposing the toast. Controller Harrison, in responding, pointed out that Toronto had the highest postal revenue, had excellent reference library, public baths, filtration plant in the course of construction, and is the home of the Canadian National Exposition, known all over the world.

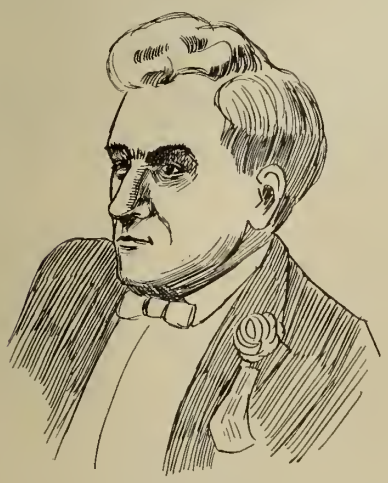
Ald. McGhie, in his reply, referred to the viaduct and electrical distribution, which, he said, would greatly aid manufacturing. Toronto was solving many large engineering problems which would place the city's public works in excellent shape.

### Manufacturing Interests.

Commissioner Harris pointed out that power and engineers were two essential to the industrial life of the country. Formerly it was customary to put the

boilers in a corner that could not be utilized for manufacturing purposes, but they are now giving more attention to the steam end of the plant, realizing that great economies can be obtained by giving the power plant more consideration.

John J. Main in replying, recalled the early days of the association and gave an outline of the work the Canadian Manufacturers' Association were doing to obtain uniform regulations in the various provinces of Canada. A uniform law would be to the interests of engineers and steam users as well as manufacturers. As it is at present there are separate laws in British Columbia, Alberta, Saskatchewan, etc., and now, by the aid of J. W. Harkom, an act and regulations have been formulated. The various provinces have been consulted and have appointed representatives to consult together at Regina on December 1st. Duncan Metcalfe will represent Ontario at this



W. C. McGhie Supports the Minister of Agriculture.

conference. It is hoped that the governments will adopt the uniform law so that the boilers manufactured in one province will be accepted in any other. Engineers with a certificate from one province will not then have to write examinations when moving from one province to another.

The toast "C.A.S.E.," was proposed by W. E. Archer and answered by A. M. Wickens, who said the engineer must be an educated man. The C. A. S. E. realized this and their meetings were devoted to the reading of papers and the education of engineers.

Chas. Moseley referred to the work the technical press was doing for engineers in keeping them in touch with engineering problems. J. C. Armer said the engineer was now having his eyes opened as to the importance of his profession.

G. C. Keith, editor of The Power House, also replied. He pointed out the importance of the engineer keeping in touch with the technical press if they wished to follow the developments in power equipment. Engineers are daily

J. J. Main Points Out the Great Strides Canada is Making in Manufacturing.

meeting new problems which the technical press was solving for them. He referred to graded certificates, which are now a probability in Ontario in the near future, and stated that in his opinion, the progressive engineer who read the techical press regularly, would be in a position to secure the first-class certificate when the Ontario Government saw their way clear to grade engineers' certificates.

**Those Present.**

The following were present at the banquet :—

S. Hetherman, C. Roddon, T. Downham, G. C. Keith, Chas. Moseley, John J. Main, W. Pakenham, Jas. S. Duff, Wm. C. McGhie, W. C. Archer, Frank

W. E. Archer Toasts the C. A. S. E. Home-Made Oil Filter.

Stubbs, Walter F. Donaldson, H. O. Mally, Sydney Turner, jr., Byron M. Armstrong, J. B. Jackson, A. H. Kirby, J. Barber, F. Boddy, J. S. Pollock, Edward B. Foy, G. Henderson, W. M. Reim, T. D. McGhie, Jas. Graham, G. Conshaw, John Reid, H. G. Ball, A. M. Wickens, R. C. Harris, Controller Harrison, D. M. Medcalf, Thos. J. Main, William Harland, Jas. F. Godbold, M. H. Kerr, Fred Simenkanap, Geo. Storer, J. C. Armer, Ald. McGhie, Geo. D. Fowler, F. G. Grutham, J. F. Bissell, N. Terry, W. White, Garfield McComell, A. V. Currell, F. J. Lucas, Wm. Sheppard, F. Stott, J. A. W. Archer, I. Kirkaldy, G. Campbell, G. K. Gillanders, J. C. Turndale, W. G. During, W. H. Grant, Geo. D. Inrie, D. Inrie, Wm. Pearson, A. J. Butcher, Mr. Tait, E. S. Buckingham, A. A. Wursteiney, B. G. McBurney, W. Giddene, W. H. Gore, G. A. Gore, J. Stewart, W. C. Derry, Jos. Moat, T. Thom-

C. Moseley Listens From the End of Table.

son, A. Taylor, J. R. Barton, H. J. Wickens, J. H. Sheales, A. M. Smith, Z. Hemphill, Chas. F. Wolfe, J. A. French, Ernest A. Wilkinson, Jno. W. Marr, H. E. Terry, W. C. Nickurn, W. H. Bowie, Otto Henderchsen, Wm. J. Marshall, Geo. Fletcher, Edward White, W. J. Bennett, D. Brown, Geo. A. Matthews, W. H. Fox, D. Small, W. Corrigan, Jas. Fielding, Jas. McReynolds, Harry M. Prudham, Fred Davies, John Brown, Jos. Hughes, Robt. Clarke, John Fenson, John Russell, Joseph Bennett, J. M. Malcolm, Richard H. Seager, J. T. Alexander, Wm. McKay, Geo. W. Grant, J. B. Thomsen, C. N. Larsen, Chas. D. Scott, B. Towers, H. Anderson, Geo. B. Towers, G. C. Mooring, John F. McCarthy, F. J. Fanell, Wm. E. Harris, J. F. Terry, F. Jones, F. Weech, F. Hutchinson, T. Hutchinson, R. V. Corrigan, Thos. J. Gerry, W. J. Charlebois, H. G. Fletcher, R. S. Mitchell, W. J. Bathgate, C. Wilmot, W. T. Crowe, A. M. Sanderson.

# A Chapter of Steam Boiler Explosions--Probable Causes

## Recent Disastrous Explosions at Aylmer, Ont., St. Clements, Ont., and Quebec Illustrate the Power of Steam—Probable Causes and their Lessons.

Aylmer, Ont., was shaken by a terrific explosion at 7 o'clock on Tuesday night, October 12th, when the Aylmer Electric Light and Water Plant was blown to atoms, and fire completed the wreck, The building of the Brandon Shoe Company, which adjoins, was also burned to the ground. Eighty men were employed in this factory and thrown out of work. The engineer in charge of the civic plant, Harry Fisher, was instantly killed, his body being found under the demolished wall of the dynamo room.

The exploded boiler was one of two horizontal tubular boilers which were used alternately. It was 72 in. diameter, 16 ft. long and 7-16 ins. thick. The bottom of the boiler was in one sheet, while the top was made in three pieces, with a dome 36 in. x 36 in. riveted to the shell. The longitudinal seams at the sides, about the centre of the boiler, were double butt strapped and triple riveted. Each side of butt the rivet holes were 13-16 ins. in diameter, the two inner rows being pitched 3 in. and the outer row 6 inches between centres. The butt straps were 8½ in. and 14 in. wide by ⅜ in. thick. The heads were ½ in. thick and were stayed above the tubes by four gusset stays in each head. The dome was held by twelve direct stays 1⅛ ins. diameter with nuts and washers inside the shell, the opening from dome to shell being 6 in. diameter. There were 84 tubes, 4 in. diameter by 16 in. long in boiler. The allowed working pressure was 125 pounds per square inch.

The rupture appears to have commenced in the longitudinal seam at the side extending from the front end, along about two-thirds of the length of the boiler, from which point it extended downwards, and around the lower part of the shell. The back head and a piece of the shell estimated weight of which is about 2,600 pounds was thrown about 300 feet from the power house. The large brick chimney was completely demolished and fell on the building. The balance of the bottom of the boiler with the two front plates at the top were flattened out, and remained almost where the boiler stood.

The plates at the longitudinal seams appear to have been flat, the boiler not being a perfect circle, thus giving a great deal of trouble. The plate appeared to have been cracked just along the outer edge of the outer of the two inner rows of rivets, the cracks extending from the outer side of the plate inwards, in some cases to within an eighth of an inch of the inner surface. This has probably been caused by the "breathing" of the boiler under different pressures.

Piece of Boiler Blown 100 ft. From Power House, Aylmer, Ont.

Result of Boiler Explosion, Aylmer, Ont.

### Some Comments.

John J. Main, of the Polson Iron Works, Toronto, to whom we are indebted for the photographs, visited the scene of the explosion and made the following comments upon the Aylmer explosion.

The boiler was no doubt badly constructed. Some years ago it was found that the circular seams over the fire would not hold and leaked continually during the winter months. Then some manufacturers got the idea of using one sheet on the bottom. By this method of construction they got over the leaking at the seam but developed a worse fault. The boiler buckled in the bottom, and owing to the heavy seam on the side, it could not be made truly cylindrical. On this account, when steam was raised the boiler took the circular shape resuming the former shape when cooled, causing breathing. The long seam cracked and was no doubt the cause of the explosion.

Some years ago Canadian manufacturers fell into the error of this con-

struction of boiler but the more conservative kept to the old plan of two or more courses in the horizontal boiler and these give better satisfaction than one long sheet.

The plate showed signs of early break previous to the explosion. The cracks were old, showing that water had passed through. It was learned at the inquest that the seam leaked previously and that the boiler was cracked probably at the construction of the boiler or as some say, by the breathing as above stated.

It was clearly shown that the safety valves were in perfect working order at 125 lbs., the pressure allowed. There was no doubt plenty of water in the boiler as there was no indication of heating the plates before the explosion. The result of the explosion further confirms the opinion that there was plenty of water in the boiler for the stored energy of steam at 125 lbs. pressure with boiler full of water shows the energy pent up in it.

One piece weighing 2,500 to 2,600 lbs. was thrown 300 ft. A chimney 6 ft. x 6 ft. x 70 ft. high was razed to the ground. The second boiler on the other side of the wall was blown 30 ft. away, landing in the machinery of the engine room. The second engine was blown through a brick wall 18 in. thick.

A piece of boiler front 600 lbs. was blown to the top of the water tower 135 ft. high above the level of the boiler room floor, and 100 ft. distant, glanced off the tower knocking off the gallery

The Aylmer Boiler After the Explosion.

and landed 600 ft. away, passing through the Catfish Creek bridge floor. Another piece was blown 400 ft. or 500 ft. across the river and passed through two floors, missing a livery stable by a few feet. Tubes, flattened and twisted, were scattered over a wide area, not one being left in the boiler.

The old Incandescent Light Station, Teranley St., Toronto, had a boiler of this type installed at one time, but was condemned by Mr. Main as being out of shape and of faulty construction and it was no longer used.

### Cause of Explosion.

This was brought out at the inquest. The evidence showed that Chief Engineer Miller had taken the best of care of the boilers; that the government inspector had gone over them only a few weeks ago and found them in good order; that this particular boiler had been thoroughly cleaned and overhauled a week before the accident; that there was a full supply of water in it when fired up on the fatal day; that this fact had been fully tested; that there was only 80 lbs. of steam on, one hour previous to the accident; that the safety valve was in good working condition and responded at 125 lbs. after the fire, showing that the accident was not due to over pressure.

Wreck of H. E. Ratz' Sawmill, St. Clements.

Experts found an old flaw under the straps of the seam in the boiler, which could not possibly have been seen or detected by any inspection, and this was the cause of the explosion.

The jury rendered the following verdict: "We, your jury, find that the said Harry Fisher came to his death as the result of an accidental explosion of the boiler used in the plant of the electric light and water department of the town of Aylmer, and that we do not find any evidence of neglect or carelessness on the part of any of those in charge, but on the contrary, from the evidence that has been presented, we believe that the boiler and all its connections were in first-class condition; that it had been well cared for and carefully inspected so far as possible, by those in charge, and that we believe from the evidence of Mr. T. G. Mitchell, an expert on boilers, that the cause of the explosion, was a fracture, which it was impossible for anyone to inspect or discover by any known method of inspection, until the accident had occurred."

### Explosion at St. Clements.

A boiler explosion at the Ratz saw mill occurred the morning of October 22 at 6.15, killing one man and injuring two others. Walter Leaper, a well-driller, of Briton, is the victim. He had been working at a well on the property of Mr. Alexander, when the explosion came. He was thrown a distance of 350 feet, and when picked up life was found extinct. The mill itself is a total wreck. Mr. Henry Ratz, the owner, estimating the loss at $5,000.

The boiler which exploded was the smaller of two horizontal tubular boilers, used in the mill, and 54 in. diameter by

11 ft. 6 in. long. It was 5-16 in. iron plate made in 4 courses of 2 plates each. The longitudinal seams were lapped and double riveted with $\frac{5}{8}$ in. rivets pitched $2\frac{1}{8}$ in. between centres. The ends and girth seams were single riveted with $\frac{5}{8}$ in. rivets pitched $1\frac{5}{8}$ in. The heads were $\frac{3}{8}$ in. thick in one piece each. There were 75 3 in. tubes, 11 ft. 6 in., long, staggered. There was a steam dome on the boiler 26 in. by 26 in., single riveted to shell, which was cut out underneath to the full size of the dome.

The boiler was at least twenty-eight or thirty years old, but no definite information could be obtained as to either its age or the name of the maker. The plate composing the shell was wasted away in places until it was less than $\frac{1}{4}$ in. thick. The boiler had been patched in several places.

There was a 3 in. spring weighted safety valve on the boiler which opened at a pressure from 110 to 120 lbs. per square inch.

On October 21st steam was raised to the blowing off point to test the working of the safety valve, which was found satisfactory. The boiler was used for about $7\frac{1}{2}$ hours on the 21st and on Friday morning the 22nd, steam was again being raised. The engineer had left for breakfast at 6 a.m. leaving the fireman in charge. At that time he states the gauge indicated 40 lbs. pressure. At about 6.15 a.m. a "well driller" named Leaper, who was sinking a well on the premises came into the boiler room, and asked that steam be turned on so that he could commence work. The fireman told Leaper to go up and open the valve himself, which he did, a moment after the boiler exploded with terrible force throwing Leaper's body over the top of the mill a distance of about 300 feet, killing him instantly.

The mill was completely demolished, the pieces of the boiler being thrown in various directions. The boiler was comparatively clean and free from scale, and there was no evidence of any recent overheating of the plate. Owing to the number of pieces into which the boiler was torn, it is difficult to determine where the fracture commenced, but apparently it started in the flange of the steam dome, extending spirally down and around the shell both in front and back of the dome.

Experts say the boiler should not have been operated at 80 pounds new, and the cause of the explosion was evidently over pressure.

Ratz Sawmill, St. Clements, after the Explosion.

### Explosion at Quebec.

A terrible accident occurred on Friday evening, Oct. 22nd, at the Chateau Frontenac, by which Edward Laurie, of Montreal, and three other Montrealers were severely injured by escaping steam.

The accident was caused by the bursting of a T-joint between two tubular boilers which are being installed in the engine room under the new wing of the Chateau Frontenac, and which are designed to run the electric plant and also to heat the building.

The injured were: Edward Laurie, skull fractured, legs broken and badly scalded; G. McDermott, Jos. McMaster, T. J. Hatton and another workman.

The accident occurred at 5.30 at which time eight or ten men were working around the boilers, which were being installed by the Canada Foundry Company, of Montreal. The work of installing the boilers and electric machinery was nearly completed, and it is stated that the boilers were working at a pressure of 115 pounds and running the dynamos in the engine room.

Without warning a large pipe with a T-joint connecting the two boilers burst. There was a terrific explosion and a rush of blinding steam, which blew those standing near the boilers some distance away. Mr. Laurie, of the Angus shops, who was looking after the engineering work, was blown about forty feet away, sustaining a fractured skull, a broken leg, and other injuries besides being terribly burnt and scalded by the escaping steam. He fell in the midst of the steam, but was rescued by Mr. John Hayes, of Montreal, who rushed to his rescue and succeeded in getting him away, although he was badly burned while doing so. One of the other men was struck by a piece of flying pipe and had a leg broken, while Messrs. T. J. Hatton, S. G. McDermott, and Jos. McMaster were knocked down and severely scalded by the steam.

---

## ECONOMY IN CONDENSING PLANT.

It sometimes occurs that the source from which the water used for cooling condensers at power stations is drawn, is at a level considerably below that of the condensing plant. It is then necessary, of course, to use a pump to force the water up to the condenser, and a large amount of power may be absorbed in this way. The water in returning to the original level, however, can be made to perform useful work. This fact has been taken advantage of by W. H. Allen, Son & Co., in the installation of condensing plants at the Newcastle tramway power station and at the Penrikyber colliery. In both these cases the condensers are considerably higher than the water supply. An electric motor is used to drive the pump which raises the water, and a turbine, coupled on to the same shaft, utilizes the returning water to furnish some of the driving power. In the case of the Newcastle installation, 2,500 gallons of water have to be raised 120 feet per minute, but the total amount of power used is only 52 kilowatts, or about half that required if the turbine arrangement were not employed. The Penrikyber plant has given even better results than this.—The Standard, London.

---

## REAL CAUSE OF BOILER EXPLOSIONS.

William Sellers, the famous machine-tool maker, was not noted as a public speaker, but when he ventured to say anything at engineering meetings his words were remembered. At one time years ago Philadelphia was much excited on the subject of boiler explosions, several accidents to boilers having wakened the natives. William Sellers attended one of these meetings, and was asked to explain his theory of the cause of boiler explosions. The reply came promptly: "Because the pressure inside is greater than the strength outside."—Railway and Locomotive Engineering.

# Practical Points in Regard to Motor Brushes

**Proper Attention Should be Given to Brushes and Commutators—Care of the these will Limit Fire and Breakdown Risks, Causes of Sparking, etc.**

By J. A. S., Newcastle.

When one considers the immense amount of thought and expense which has been spent during the past years in order to bring the efficiency of dynamos and motors up to their present high standard, it is rather surprising that the users of such machines pay such a little amount of attention to the actual wearing of commutators and brushes; their attention usually only being called to these matters when the machine ceases to turn round.

It is possible that this may be to some extent due to considerable ingnorance, not only on the part of the users themselves, but also of the erectors of the machines. In spite of our advanced knowledge and realization that infinite care should be taken with the design of every portion of such machines, there appears to be a general impression that so long as the machine runs without danger or sparking, and drives its load a considerable amount of wear must of necessity take place on the commutator, and that new brushes must be frequently supplied. Now and again when frequent repair becomes an object of comment, the reason may be advanced that the brushes or the commutator are too soft, and the manufacturer is blamed.

As the result of extended experience in attending to motors, which have been accused of chronic sparking, and which, after alteration have been able to run at considerable over-loads without such sparking, the writer ventures to say that nine-tenths of the machines of fairly standard make can be rendered sparkless by proper adjustments, and a little attention. It is not necessary in this connection to bring forward any new theories, and in the following notes nothing further than practical advice will be tendered, with which many readers will probably be familiar. It is, however, necessary to point out the economies effected, and the limitation of fire and breakdown risks obtained if proper attention is given to the brushes and commutators.

### Sparkless Running.

If the sparking can be reduced to a minimum, it is obvious that the brushes will only be worn away and not burnt. Moreover, it is obvious that the commutator will get a good skin, and excessive wear of its surface will thus be prevented. In a number of cases within the writer's experience the wear on the commutator has been reduced from one-eighth of an inch to one thirty-second of an inch depth per annum, and hence the life of such a commutator is multiplied by three.

In order to effect sparkless running the following points are absolutely essential, and the machine should not be left as fit to run normally until complete accuracy in every detail has been obtained. A frequent cause of excessive sparking lies in the fact that the brush rocker is not placed in the best position for sparkless running having regard to the load the machine has to do. Although a great number of manufacturers place a mark to show the neutral position of the brush, it has unhappily not been the writer's experience to find that the positions of these marks are accurate to within one-sixteenth of an inch, which implies a rather rough and ready testing method on the part of some manufacturers. The netural position is generally found by trial, but a very much more accurate method is as follows:

It may be advisable to warn readers that only those who are really experienced in handling electrical machinery should attempt this, as it has to be conducted with great care. A piece of copper should be taken whose breadth is equal to the width of two commutator segments, and it should be slightly radiused so as to fit the surface of the commutator. It should also be provided with an insulated handle. This should be held in the hand, and while the motor is running the copper should be pressed on to the commutator near the brushes, and moved slightly backward and forward until no spark flies from the edge of the copper.

It will be seen that this copper strip forms a short circuit between two adjacent bars of the commutator, and should there be any potential developed in the coil at the point corresponding to the position of the bar, a local current will be set up round that coil, resulting in a spark. Where no sparking occurs, voltage is as nearly as possible zero, and hence indicates the neutral point. The advance to lag or lead in moving the copper bar should be very slight, and must on no account amount to more than three-quarters of an inch on each side of the brush. When this sparkless position has been obtained the brushes should be brought back or forward to exactly the position of the copper, or centred by it, thus moving them to the neutral point. A mark made by a chisel or scriber is then quite sufficient for future use.

Of course, everybody knows that when a machine is running as a motor, the brush rocker should be turned slightly back as regards the direction of rotation of the motor, and when running as a generator, the rocker should be slightly forward. No rule as to distance can be given, as this depends partly on the load to be driven and partly on the design of the machine.

### Spacing Brush Gear.

The next point of importance is to prove that the brush gear is so spaced, that exactly the same distance is maintained between each set of brushes. It often occurs that the positions of the brush arms are knocked out of true when the motor is being erected, and sometimes sufficient care is not taken in erection to space these arms quite accurately. Until this spacing is corrected, sparking will continue to present itself. One obvious method of checking this is to count the number of segments between each set of brushes; each number should be the same for each set. It is necessary in such a check to note that each brush in a set is exactly in line with the rest of the brushes. A very handy and accurate way of making this check is to take a strip of tracing paper, and mark the front of each brush with a finely pointed pencil on the paper. By stretching this paper round the circumference of the commutator it is possible to measure accurately the distances between each set of brushes, observing at the same time that the rake of each brush is the same. This precaution is necessary in order to make sure that all the faces presented to the commutator are of the same width.

In some motors the makers provide a wide brush, sometimes covering three or more segments. When everything else has failed, the writer has known a reduction of this width to completely cure sparking, the reason probably being that the excessive width of the brush enables a local short circut under voltage to be produced between adjacent segments of the commutator. Too much care cannot be paid to the bedding of the brushes, and it is greatly to be feared that this frequently obtains very scant attention. It must be remembered, however, that insufficient bedding of a single brush is liable to overload the carrying capacity of the other brushes, which are properly bedded, and thus to cause disintegration of the carbons and destruction of the commutator face. It is

therefore evident that a quarter of an hour extra spent during the time of bedding the brushes, will probably save an hour afterwards.

New brushes should be first bedded with rough sandpaper, and then again with very fine sandpaper, and the writer has always insisted that after the machine has run for about five minutes, the brush faces should be examined. If it is found necessary, they should again and again be bedded, until they bear on their whole length on the commutator. After the brushes have been bedded the machine should be watched carefully for about two days in order to see that a good smooth face is appearing on the commutator, and also to make sure that no little pieces of copper have become embedded in the face of the brush. The presence of such particles would produce scoring of the commutator surface and prevent a proper skin being obtained.

It is worth while emphasising that the brush pressure should in no case (except where special brushes are used with manufacturer's specified pressure) exceed 1 lb. tension. It is a very common practice, when a brush starts to spark, to tighten up the tension device to an ultimate figure very largely in excess of the proper value; the result of this practice being undue wear on the commutator. The writer has frequently found cases where the brush tension has amounted to 6 or 8 lbs.

### High Mica.

The next thing that is very likely to cause sparking in a good machine, after the above points have been rigidly attended to, is high mica. This is caused by the wearing of the copper at a greater rate than the mica, thus leaving ridges in the latter material, which the brush must leap over in order to obtain contact with the copper at the moment of short-circuit. The remedy for this is, of course, very obvious, consisting of removing the mica not only down to the surface of the commutator, but slightly below it, in order to allow the copper to project. In some cases the mica is removed to the extent of one-sixteenth of an inch, by means of a fine saw, below the surface of the commutator, but the writer insists that this should not be allowed to occur. The reason for this is that there is a great tendency for any carbon particles detached from the brushes to lodge in the cuts.

The writer very strongly recommends that a V-shaped mark should be pushed along the centre of the mica once every 3 or 6 months, depending upon the amount of running which the machine has to do. The centrifugal force developed by the running of the machine is quite capable of throwing out the carbon particles from a V-shaped groove, whereas they would be very likely to lodge in a square groove, and thus set up short circuits between adjacent commutator segments.

It is apparent that a considerable amount of the above matter is very well known to pratical electrical engineers, but unfortunately it is also very much neglected, and the unfortunate manufacturer is badly rated for failings, which in a good many cases could be remedied by close attention to the above details. It may be useful to remember that in addition to all the foregoing hints there yet remains to be stated one of the most useful cures for troubles which are not really chronic or internal in electrical machinery. It is the first and last factor in any emergency in running plant and can be summed up in one word—"common-sense."

## THE COST OF HYDRO-ELECTRIC POWER.*

By L. G. Read, M.E., A Mem. C.S.C.E.*

After all the millions of dollars which have been invested in the development of water powers—and certainly in the light of "conservation of natural resources," it cannot be regretted—yet it must be said that hydro-electric power never was, is not, and never can be, the cheapest power.

An immense volume of water falling over a precipice, with vast energy going to waste, without doing work—in a world where so much needs be done—seems to demand development. But what are the facts?

What does it cost to avail ourselves of this great power? Let us take as an illustration a hypothetical case, so that we can deal with the simplest elements involved in the development, transmission and sale of hydro-electric power—meaning the development of electric current by means of water power; the equipment consisting of dam, head race, flumes building, water wheels, electric generators, tail race, and all the necessary auxiliary apparatus for control and operation of the plant.

On a given stream and at a given point there are falls—or rapids. The amount of water passing over this given point equals say 200 cubic feet per second.

A cubic foot of water (at 62 degrees F. and at sea level) weighs a little over 62 pounds. 200 cubic feet would therefore weigh 200 x 62 equals 12,100 pounds per second, and as there are 60 seconds in a minute, then 60 x 12,100 equals 744,000 pounds per minute. Now suppose the height of the fall is 30 feet. Then 30 feet times 744,000 pounds would equal 22,320,000 foot-pounds, and, since 33,000 foot-pounds per minute equals one horse power, then 22,320,000 foot-pounds divided by 33,000 foot-pounds would equal say 675 horse power; and, to avoid unnecessary figures—covering losses and allowances—let us assume that just this amount of water foot-pounds are sent into the water wheel every minute. The efficiency of the water wheel—that is to say—the amount of actual energy which a water wheel will give off is only about 75 per cent. of the actual amount of water foot-pounds sent into it. Hence at the very first move there is a loss of 25 per cent and the 675 h.p. (minus 25 per cent.) is reduced to say 500 h.p.

The efficiency of the electric generator (which would be driven by the water wheel) would not exceed 85 per cent., at average loads, and so our 500 h.p. must be reduced again by 15 per cent., or down to say 425 h.p. Then transmission and transformer losses would be equal to another 15 per cent.—bringing the 125 h.p. down again to say 360 h.p. In other words we started out with 675 water horse power—making the development, capital investment and all on the 675 h.p. basis—and find when we get to the other end of the wire we have only 360 h.p. and that, too, is only at the consumers' motor and not in it. The motor (which, let us assume, is driving the consdmers' factory) registers also a great loss in that its efficiency, under varying loads, will not average better than 75 per cent., so, then the 360 h.p. drops again to say 275 h.p.—four hundred horse power less than we started with, or an overall loss of nearly 60 per cent. So much for the overall power efficiency of hydro-electric current.

These figures can be doubled or multiplied by 10 or 100 (to get into larger powers) but the per cent. of losses will remain practically the same. They cannot be escaped. Nature is inflexible in her law—that she shall not give us something for nothing—and if we have a thousand horse power of work to be done we must be content with the unfortunate necessity of harnessing twenty-five hundred horse power with which to do it!

Nor is that the only indictment. When hydro-electric current is transmitted over any considerable area, for consumption, as power and lighting, by a number of users, the greatest loss lies in the fact that, whereas the generating plant, lines and equipment are all designed to deliver say 10,000 h.p., it is impossible to sell all the power all the time—for the simple reason that human activity is not constant—in fact its needs for light and power are extremely inconstant.

* This article sets forth the views of the gas producer manufacturer, written by the Mechanical Engineer of the Colonial Engineering Co., Montreal.

Public street lighting averages only eleven hours per day, domestic lighting only three hours and, with very few exceptions, industrial power is never over ten hours per day.

All the constant elements have to be carried by the water power : that is to say—the investment demands its returns all the time : the water flows over the falls all the time—as against which only a part of the consumers use current only a part of the time. The result is that the constant average output of current actually sold is only fifty (in a few cases sixty) and more often thirty to forty per cent. of the plant's constant capacity and hence the consequent—indeed absolute necessity of a price being charged which will compensate not only for the 60 per cent. power losses first pointed out, but for all the power all the time whether consumed or not !

In short—a price must be charged per annum per horse power, or per kilowatt, which will make good all these losses and inconstant elements—whatever the average actual output of current may be—and somebody has to pay for it—needless to say the consumer.

So—when the individual consumer comes to consider these facts—he should remember that, if his requirements for power and light are as much as say 20 h.p., and upward, he can instal his own engine and generate his own current on a far more economical basis and be infinitely more independent and more generally satisfactory.

For hydro-electric current he must pay (for lighting) from 6 to 12 cents per 1,000 watts, as against this he can produce it himself for 1 to 1½ cents. For hydro-electric motive power he will pay $30 to $50 per year per h.p., as against which he can produce it himself— easily —for $20—with all the losses and inconstant elements (so far as they apply to his individual case) and all operating and fixed charges included.

## SOME RECENT MEETINGS.

A social evening was tendered to the members and prospective members of the Central Railway & Engineering Club, Toronto, in the dining room of St. Charles restaurant Nov. 5.

A meeting of the general section of the C.S.C.E. was held at 413 Dorchester Street West, Montreal, on Oct. 23, when E. I. Wenger read a paper on "Determination of Train Resistance."

On Wednesday afternoon, Nov. 3, T. K. Thomson, C.E., of New York, addressed the Engineering Society of Toronto University on ."Foundations for High Buildings." In the evening, the S.P.S. Alumni held their first dinner of the season, at the St. Charles Hotel.

At a recent meeting of the McGill Science Undergraduates' Society, the following officers were elected for 1909-10: President, O. N. Brown, '10; vice-president, J. N. Timberlake, '10; secretary, P. H. Skelton, '11; treasurer, G. H. Walker, '11; reporter to Martlet, A. A. Clark, '10.

A Railway Engineman's Educational Club has been organized in Winnipeg and Kenora. In the former place there is a membership of 250 and 50 in the latter. The headquarters of the organization are in the Empress block, Winnipeg. The following are the officers: President, C. A. Boyd; vice-president, J. McLachlan; secretary, G. F. Collins; treasurer, W. S. Metcalf.

The monthly meeting of the Canadian Railway Club was held in the Ladies' Ordinary of the Windsor Hotel, Montreal, at 8.30, Nov. 2, when a paper was read by R. W. Burnett, general master car builder, Montreal, entitled, "Maintenance Regulation Cards."

At the regular open meeting of Toronto Lodge, No. 1, C.A.S.E., in the Forum Hall, corner Gerrard and Yonge Streets, Oct. 15, Mr. Henderson, of the Schofield-Holden Co., Toronto, read a paper on "Marine Gas Engines." After a discussion a progressive euchre party and smoker followed. The first prize was awarded to Herb Terry, being a safety razor. The second prize, half a dozen silver spoons, was awarded D. A. Murray, and the booby was awarded T. McGhie.

At a meeting of executive of the C. A. S. E. Exhibitors' Association, held in the King Edward Hotel, Toronto, Nov. 1, E. Fitzgerald, superintendent and chief engineer of Berlin Steam Heating Co., was elected Hon. Pres. of the association. G. C. Keith, editor of The Power House, was elected auditor.

## COMING MEETINGS.

C. S. C. E. (Toronto Branch) Nov. 15 — Address by Allen Hazen on "Water Filtration." Regular meeting Nov. 25. C. A. S. E. (Toronto Lodge) Nov. 19.—Open meeting. All engineers invited.

A. S. M. E. annual meeting, Dec. 7-10, 1909, 29 W. 39th St., New York City.

Engineers Club (Toronto), Nov. 11.—"Some points in the Construction of the Simplon Tunnel." Illustrated by lantern slides. Paper by Mr. Chas. B. Fox, M.A. Nov. 18.—"Facts and Figures relating to Producer Plant Practice." Paper by Mr. M. Chapman.

The next regular open meeting of No. 1 Lodge, C. A. S. E., will be held in the Forum Hall, Toronto, Nov. 19, when H. S. Brown, of the Canadian General Electric Co., will read a paper on "High Efficiency Electrical Illuminants." This will be followed by a progressive euchre party and smoker. All engineers and their friends will be made welcome at the open meetings. Arrangements are being made for a series of excellent papers to be read at the open meetings on the third Friday of each month.

## NOVA SCOTIA SOCIETY OF ENGINEERS.

The regular monthly meeting of this society was held Nov. 11, in room 35 of the N. S. Telephone Co's Building, Hollis Street, Halifax. A paper on "Canadian Transportation," was read by R. Coutlee, Divisional Engineer Georgian Bay Canal.

On Dec. 9 a paper will be read on "Improvements of the Telephone," by J. H. Winfield, General Manager N. S. Telephone Co.

## A REFRIGERATING TURBINE.

A French inventor has constructed a refrigerating machine of entirely new type. This machine consists of the combination of a steam ejector with a turbine used as a condenser. The steam ejector used with the condenser produces a vacuum over a receiver filled with brine ; the water, as it evaporates, produces a progressive degree of refrigeration. The steam jet, as discharged from the ejector, enters a receiving chamber where the steam passes through a series of converging tubes, which at their outlet end are again made to diverge. Thence the steam reaches the condenser which is a reversing turbine with the injection of water at the centre. The steam from the ejector, together with that from the brine vessel, which is carried over along with it, becomes condensed in the turbine. A centrifugal pump, keyed on the same shaft as the condensing turbine, causes the active circulation of the brine. The constant vacuum maintained in the receiving vessel helps to draw in brine. The steam pressure at the ejector is 4½ lbs., and in expanding, it assumes a speed of 3,900 ft. per second.—The Steamship.

George C. Royce, 22 Dundas Street, Toronto, has obtained the contracts for 300 single phase A. C. Ferranti meters for Fernie, and 500 of the same type for Ladysmith, B.C. Ferranti meters will also be supplied for power supply.

# PRACTICAL ARTICLES BY OUR READERS

Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.

### LIFTING WATER FROM A DEPTH GREATER THAN 34 FEET WITH AN ORDINARY SUCTION PUMP.

According to the laws of physics, the pressure of the atmosphere is equal to that of a column of water 34 ft. in height, and this height is the maximum lift theoretically possible with an ordinary suction pump. An ingenious French machinist, however, has found that by running a small tube (about ⅜-in.) from the free air down in the well and curving its lower end upward so as to project into the pump suction pipe, it is possible, by working the pump rapidly, to lift water as high as 65 ft. The principle is that employed in the air-lift pump. The column rising in the suction pipe is an emulsion of air and water, whose density is less than that of water, the air being drawn in by the partial vacuum produced by the pump plunger, and mixing with the water. To operate successfully, it is necessary that the velocity of the pump plunger shall be greater than the velocity of ascension of the air bubbles in the suction pipe.

---

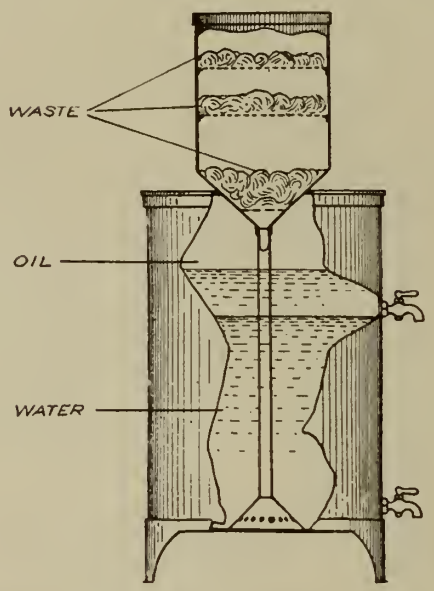
### OIL FILTER; SAW DUST.

A cheap filter that does good work is made as follows : Use an old discarded waste can that has several holes in it as the body, insert a pet cock at the bottom for the water, and attach an old bib from an ice cooler for the oil outlet. Two old 5-gal. oil cans that leak at the bottom can be used ; one as the filtering chamber can be made by cutting the bottom off about 1 in. up, leaving a rim, then spread out slightly, turn the cut edges a little and this bottom can be used as a cover. Now make a cover for the waste can of some light boards or tin, cut a hole a little smaller than the top of the oil can, so that it will rest on it. A piece of 1-in. pipe is now screwed or forced into the neck of the can, this should reach near to the bottom.

Cut the top from the other can, a little smaller than the hole in the cover so that it can be removed and force over the lower end of pipe, this acts as a spreader for the oil. Put a piece of burlap or wire screen in the bottom of the filter chambers and waste on top of this. Several screens can be put in if desired, and hung on wires ; a gauge glass can be added if desired.

My filter cleans about 2 gal. of oil a day and the oil is as good as new. The filter did not cost a cent, it took about 3 hours to make it, and has been in operation several months. I remove the top layer of waste about once a week, but the rest remains 2 months, when I clean the whole apparatus. It is surprising how much dirt there is in the bottom of the water space. If kept in a warm place so that the water will be warm, it works better as the oil is clearer.

How many of us know the value of saw dust about the engine room ? It is as good a cleanser as waste, and far



Home Made Oil Filter.

cheaper. It is often considered a nuisance and burned up, yet I would rather be without waste than saw dust. If kept in a good can with a cover nobody will object to its presence and that which has been used can easily be burned.

Where there is always more or less oil and grease around the engine, a little saw dust thrown about will quickly absorb. When tools are dirty and greasy, I simply throw them in the saw dust can, rub them well and they come out bright and clean.

Oily hands are more easily cleaned with saw dust than with waste by giving them a good rubbing with it. Oil spilled anywhere is easily removed with saw dust by throwing some on the oil; let it remain a while, and then sweep up.

When burning saw dust or other rubbish, I place a board or several pieces on the fire, or if the fire is light, I clear a space in the centre, place the board on the grate and the material to be burnt on top in a pile : open the damper wide and I get but little smoke. I get from 6 to 9 barrels of rubbish to burn every morning, and find this the best way to dispose of it. It makes a little smoke at first, but only for a few seconds, and when burned, leaves a clean place on the grate which is easily covered with coal.—Practical Engineer.

---

### LABORATORY ANALYSES VERSUS BOILER TESTS.

It has usually been considered that the "proof of the pudding is in the eating" is the best test that can be applied. In other words, engineers have placed greater faith in an actual boiler test conducted under working conditions than in laboratory tests or analyses. In the very instructive and interesting publication, "The Purchase of Coal," by the Arthur D. Little, Inc., Laboratory of Engineering Chemistry, Boston, the advantages of the scientific laboratory test are briefly given as follows :

"The results of a great many tests on coals burned under boilers have shown as a rule, other conditions being the same, the B.t.u. are a direct measure of the amount of steam which may be generated by a ton of coal. When a proper sample of the coal is secured, the chemical analyses and calorimeter determinations for B.t.u. are a better guide to the value of the coal than are one or two boiler tests for the same purpose, for the reason that the tests in the laboratory are conducted under constant conditions, while it is usually impossible to run two boiler tests under the same conditions, making the two tests comparable. It is only when a considerable number of boiler tests are run on the same coal and the averages taken that the results may be considered as conclusive."

---

### FORCING CAPACITY OF BOILERS.

When fire tube boilers were built with closely crowded small tubes and gas passages were badly designed, and when now obsolete water tube boilers were in existence, there was some reason for the idea that the former type had relatively less capacity to be

worked above its rated capacity. But to-day with a better knowledge of all types of boilers, the general impression held by interested parties is undoubtedly, as Prof. R. C. Carpenter has publicly stated, that fire tube boilers are capable of being forced more than water tube.

The capacity produced by a boiler is manifestly dependent on two things : 1. Quantity and disposition of heating surface. 2. Amount of heat supplied to it. The latter has much more influence than the former, because if a boiler is supplied with a large quantity of heat, it will produce a large capacity. Decreasing efficiency, of course, reduces the capacity, but at a very much lower rate than the increase due to increasing quantity of heat supplied, therefore large capacity is more dependent on the fire than on the boiler.

The old time basis of rating the horse-power of horizontal return tubular boilers upon 15 square feet of heating surface per horse-power has been reduced, as its inadequacy to represent modern conditions has been more fully realized.

What such a boiler can do has been clearly demonstrated. Mr. F. W. Dean, mill engineer and architect, of Boston, has shown in the case of 60-inch boilers with fifty-five 3½ inch tubes 20 feet long, a heating area of 1,112 square feet, and a grate area of slightly over 21.5 square feet, that a horse-power could be obtained.

It will be observed from these results that a horse-power was obtained from 8 and 7.7 square feet of heating surface, that 6.37 and 6.73 horse-power were obtained from each square foot of grate, that 0.41 pounds and 0.42 pounds of coal were consumed per square foot of heating surface per hour, and that those results were obtained with not over ¼-inch of draft. These results are quite remarkable, especially as the economy was not very inferior, and considering the age of the boiler which was 24 years, during which no change had been made in the tubes and they had never been cleaned on the water side.

Other tests made by Mr. Dean upon 90 inch horizontal return tubular boilers with 258 tubes 3-inch diameter by 20 feet long, showing the following results :

| | Hand. | Stoker. |
|---|---|---|
| Temperature of escaping gases | 569 deg. | 645 deg. |
| Horse-power per square foot of grate | 12.92 h.p. | 12.00 h.p. |
| Heating surface per horse-power | 6.39 sq. ft. | 5.43 sq.ft. |
| Dry coal burned per square foot of grate per hour | 12.2 lb. | 37.6 lb. |
| Dry coal burned per sq. ft. of heating surface per hr. | 0.51 lb. | 0.58 lb. |
| Water evaporate per square foot of heating surface per hour from and at 212 degrees | 5.39 lb. | 6.35 lb. |

The stokers were of the Babcock & Wilcox chain grate type.

The rate of combustion, the temperature of the escaping gases, the small heating surface per horse-power, the amount of coal burned and the horse-power developed per square foot of grate, and the amount of coal burned and water evaporated per square foot of heating surface are truly remarkable and are seldom equalled. They show that this type of boiler is as well suited to forcing as any, and leave nothing to be desired. The water used was determined for each hour, and during one hour the horse-power of one boiler was 794, and with the other 793, or about five square feet of heating surface per horse-power. It should be noticed also that the temperatures of the escaping gases are remarkably low considering the quantity of coal burned per square foot of heating surface. The maximum flue temperature was on the hand fired test 630 degrees and on the stoker test 700 degrees.

---

## EXPERIENCE ON THE ROAD.

H. L. Beach.

### Power Plant Operation.

When the writer took charge of the plants now under his direction he was informed that some difficulty had been experienced with the generators at the largest plant in the district. This plant consists of two direct-connected, 25 cycle, three-phase alternators of 300 and 400 kw capacity respectively, driven by horizontal non-condensing engines. Both generators operate at 5,600 volts, the 400 kw machine running at 125 r. p. m. and the 300 kw machine at 187.5 r. p. m. The load on this station consists of a 5,600 volt synchronous motor driving a 250 kw. 275 volt direct-current generator and three 250 kw 275 volt, rotary converter sub-stations. The direct-current load is a typical railway load. The switchboard was so designed that the two generators could be run separately or in parallel. When run separately it was necessary to operate the rotary converters from the 300 kw generator and the 250 kw motor-generator set from the 400 kw generator. The main generators could be excited either from their own belt driven separate exciters or from the motor-generator set, or from an independent direct-current unit that was ordinarily used for town lighting purposes and could be switched on if required. It seemed to make no difference how the machines were excited as the results were the same. Usually the excitation was taken from the motor-generator set.

It was stated that the 400 kw unit would lose its voltage, and consequently its load, at almost any time. The trouble was thought to be due entirely to the 100 kw generator. Two experts had been sent to correct the trouble before the writer was acquainted with the plant and another at the time he took charge. This last man reported that the operating men were ignorant and could not run a modern alternating-current machine, that the rotary converters were allowed to run at a higher voltage than the motor-generator set, thus the higher direct-current voltage from the rotaries overbalanced the lower voltage of the motor-generator set, causing it to reverse its polarity, which in turn reversed the field excitation of the synchronous motor and caused it to fall out of step and pull down the generator voltage. At the time of the writer's first visit all of the machines were getting their excitation from the motor-generator set. If anything happened to it the voltage of the whole plant went down. The expert also claimed that the synchronous motor was highly over-excited and that the leading current thus forced through the armature of the main generator, caused the operators to carry a weak field on the main generator. The two main units were not being run in parallel for reasons which will be described later.

The expert looked over the entire plant and gave orders to increase the voltage on the direct-current generator of the motor-generator set, increase the excitation on the 400 kw unit and decrease the excitation on the rotaries so as to reduce their voltage by causing a heavy lagging current in the line and thus a large line drop. He claimed that the rotaries, being compound wound, would correct this as the load came on. The trouble, however, did not disappear, and it has since developed that the series field in one of the rotaries was reversed so that instead of building up the voltage, it lowered it as the load came on.

In order to properly investigate the causes of the trouble, the writer started at the beginning and looked up the specifications and guarantees of the machines, discovering among other things that the engine connected to the 400 kw machine was designed for 125 lbs. throttle-pressure, while they were carrying from 80 to 100 lbs., and the safety valves on the boilers were set for only 115 lbs. The setting of the safety valves was changed to 140 lbs. and the pressure carried to 135 lbs., with the result that the unit gives absolutely no trouble, and has

never failed to hold up its voltage, under the worst conditions of fluctuating load and heavy overload.

When the writer asked the operators to run the two machines in parallel all the time, as the load was too heavy on the 300 kw machine, he was told that they would not run in parallel. This developed the fact that the machines hunted so badly when connected together that the governor of the 400 kw unit bumped the wheel of the engine very viciously. At best, whenever the two units were together the revolutions of the 400 kw unit could be counted as accurately with a direct-current volt-meter connected between the trolley wire and the rail at the far end of the trolley line, as they could be counted when standing alongside the engine.

The writer again went after the engine instead of the generator. This type of engine has a very sensitive governor, which is not supplied with a dash pot. The makers claimed that a dash pot was entirely unnecessary, but, after their man had experimented with one with good success, it was decided that "a dash pot has a very soothing effect upon the operation of an engine running an alternator" to quote from the engine people. Since the addition of this piece of apparatus to the engine, it has been found perfectly feasible to run the units together, but the long run of trouble experienced had given the large unit such a bad name that every time anything happened, the first thing the operators thought of doing was to pull out the switch between the two alternators, shifting the bulk of the load to the 300 kw unit. To stop this, the writer had this switch cut out entirely and the two machines connected to the same bus-bars, through their own switches and the switch which was formerly used between them is now used as a disconnecting switch to cut out the outside lines. The plant now runs very satisfactorily and the men are really getting to like the "big" unit as they call it.

### Paralleling Two Direct-Current Generators.

The original plant in this case consisted of a 150 kw, 220 volt, compound-wound generator direct-connected to a horizontal non-condensing engine running to 200 r.p.m. A new unit was purchased of exactly the same size and speed but for 250 volts and of a different make. It was at first said that it would be impossible to run the two machines in parallel on account of the different compounding characteristics, and on account of the lower voltage of the old generator. The writer, however, had the switchboard built for parallel operation. The old generator was thoroughly overhauled after the new machine was running. When repairs were completed the machine speed was raised a few revolutions per minute when the higher voltage was found to be easily obtainable with quite a little of the field rheostat in circuit.

As the compounding characteristics of the two machines were known to be different, a frame of grid resistance was procured and mounted alongside the old generator so as to be available for shunting the series field and thus equalizing the compounding. The machines were then parallel and an attempt made to equalize the load by adjustments of the shunts on the two fields. It was found that the old machine would take two-thirds of the total load and no adjustments of the shunts would alter the result. It then occurred to the writer that the resistance of the series field of the old machine was so much less than that of the new that no matter what shunt was used the current would divide so that more would go through the old field than the new. The grids in the frame were accordingly connected in parallel and the resistance thus obtained was connected in series with the series field of the old machine. The machines were then connected in parallel when it was found that the load divided absolutely evenly throughout the entire range of the machine.

The results of this experience have led to the conclusion that, contrary to usual practice the proper way to get proportional loading on two compound-wound direct-current generators is to adjust the resistances of the two series fields in inverse ratio to their kw capacities and then adjust with shunts for equal compounding if desirable. The writer has proven to his satisfaction, however, that a machine much over-compounded will parallel successfully with a machine of even compounding, provided the resistances of the series fields are properly adjusted.—Electrical Journal.

---

### DEFINITION OF KILOWATT.

Electricity is measured by the kilowatt hour. The rates for buying current from the electric light plant for power, light or heat, or for charging the electric runabout, are always so much for each kilowatt hour of electricity consumed. This is just so much greek to the average man, and if you tell him a kilowatt is one and one-third horsepower, he will only get a faint idea of what it is all about.

To explain the term needs, first, a clear definition, and then a comparison. Everyone will understand that a certain amount of force must be used to drive electric current through a circuit. This force is measured by volts; thus we have 110-volt currents and 220 volt currents, the one expressing just twice the force of the other; but the quantity of current passing through a circuit depends on the force and the resistance, and so the quantity is expressed by a different term, namely, "amperes."

Now the efficiency of the current depends upon both force and quantity, and to express this efficiency or united action we multiply the force by the quantity—that is the volts by the amperes and express the results in watts. Thus 110 volts multiplied by 5 amperes is 550 watts, or 220 volts multiplied by 5 amperes is 1100 watts. A kilowatt is, of course, 1,000 watts, which is the equivalent of about 1 1-3 horse-power.

In charging a battery the lighting company's bill for the use of so many watts for so many hours—thus, 1,000 watts for ten hours would be charged as 10 kilowatt hours, which at 5 cents a kilowatt hour, would be 50 cents, a charge that seems little enough for 10 hours use of 1 1-3 horsepower.

But what a kilowatt hour is worth may be judged by what it will do. Thus a kilowatt hour, figures an engineer of the General Electric Co., will light 20 16-candle power incandescent lights or two standard arc lamps for one hour; it will pump one hundred gallons of water to a height of twenty-five feet; compress 170 cubic feet of free air 100 pounds; drive an ordinary passenger elevator 175 feet; print 2,500 circulars on a 15x21 job press, or 1,000 sheets on a 32x47 cylinder press; run a sewing machine for two hours; supply air for a church organ for one service; mix 2½ cubic yards of concrete; heat a two-pint chafing dish for four hours; mix sufficient dough for 150 loaves of bread, and grind six hundred pounds of coffee; it will drive a runabout 4½ miles, or a 3-ton truck one mile.

---

### ENGINE SPEED REGULATION AND TUNGSTEN LAMPS.

The fact that the relatively new tungsten incandescent lamp is considerably more sensitive to voltage variation than the old carbon-filament lamp is well known to electrical engineers, but either the fact itself or its relation to reciprocating-engine performance seems to have escaped the attention of some designers of such engines, not to mention consulting engineers, architects and others concerned more or less directly with the installation of engine-driven electric-lighting plants.

A corporation decided to build a large office building in a certain inland city, and employed metropolitan architects to make the plans and supervise the entire construction. The plans and specifications covered the electric-light plant,

which was, in a measure, modified to meet the desires of the man who was to be chief engineer of the building. He was familiar with a certain make of engine, and the change was only such as would let in this particular engine. The features called for as to the engines were a speed of 200 revolutions per minute ; speed variation not to exceed two per cent.; flywheels of a certain weight, and operation to the satisfaction of the chief engineer of the building and the architects. Just what the specifications as to the electric generators were we do not know, but the machines were multipolar generators of 100 kilowatts capacity, designed to run at 200 revolutions per minute.

The contract was let by the owners to a large contracting concern, and they sublet the contracts for engines and generators to separate companies. This was at a time when tungsten lamps were just beginning to be used, and nothing was said in the specifications about them. The engine builders having seen but a few of the lights supplied from generators driven by their engines had no reason to think there was anything peculiar about them. When the plant was erected and the lamps then commonly used were put in no complaint was made, but as soon as tungsten lamps were put in they flickered to such an extent as to be a source of complaint, and the plant has not been accepted by the engineer and architects.

The electric-light people claimed that the fault was in the engine governors, but when the indicators followed a constant line for three minutes, that claim was rejected. Then it was claimed it was due to insufficient flywheels, but these proved to be 25 per cent. heavier than the specifications called for ; besides, a similar engine with a flywheel very much lighter, but with a different generator, gave steady light at 200 revolutions.

But now a new card was played by the electric company's agent. One engine was disconnected, and a motor set up to drive its flywheels and generators ; this gave a steady light. Consequently, the buyer's representatives claim it is up to the engine builders to give a steady rate of turning at the engine shafts.

The electric people have filled their contract (so they claim) ; the engine builders have filled their contract (so they claim) ; but the chief engineer and architects won't accept the plant. Hence, neither get their pay.

The mysterious feature of the case is that nobody seems to have discovered that the source of the trouble is not speed regulation but changes, within each revolution, in the velocity of the flywheel rim, which no governor can correct or control, and which no steam-engine indicator can indicate.

The moral, however, is that if you want to supply high-efficiency incandescent lamps from a generator driven by a reciprocating engine, the "angular variation" in the speed of that engine must be smaller than would be allowable with low-efficiency lamps.—Power and The Engineer.

## NOVEL USE OF GAS ENGINES FOR BOOSTING GAS PRESSURE IN TRANSMISSION PIPES.

An important instalation of Westinghouse gas engines for boosting the pressure in its illuminating-gas pipe lines, has recently been contracted for by the Public Service Corporation of New Jersey. At its Hoboken and Passaic plants, four Westinghouse vertical, 13-inch by 12-inch, gas engines, equipped with special regulating mechanism, will be employed to drive direct-connected Root blowers delivering gas at pressures varying from three-fourth pound to four pounds per square inch, as desired.

The delivery of gas by the blowers is automatically made to conform to the demand on the gas lines, by increasing the speed of the engines as the pressure in the mains tends to fall. To accomplish this, a special controlling valve has been added to the engine equipment, which throttles the fuel admitted to the engine, adjusting its speed between 290 and 125 revolutions per minute, as the demand for gas varies. The controlling valve is operated by a piston, to which pressure from the gas reservoir line is admitted, and which moves against the compression of a helical spring to close the fuel valve as the line pressure rises. The controlling valve is fitted with a positive stop so adjusted that, even though the line pressure reaches its full value, the fuel valve cannot close beyond a point where the engine will continue to turn over on light load, thus avoiding the necessity of re-starting the engine when the blower pressure is again required. While it is estimated that the minimum demand on the pipe lines will probably absorb the delivery of the blower at its lowest speed, (125 revolutions per minute), any possible abnormal rise in pressure is prevented by the provision of relief valves which automatically open a by-pass around the blower, enabling the engine to run light while performing no other work than circulating the gas in its local circuit. A standard governor device has also been supplied with these engines, designed with considerable play or backlash, so that the governor does not control the gas admission until the engine speed exceeds 250 revolutions per minute. Above this, the governor travel takes up the backlash, throttling the gas and preventing any possibility of overspeeding in case the pressure in the transmission line should suddenly be relieved.

The location of the boosting equipment dictated the use of a magnet generator for ignition current, driven from the main engines. The feature of obtaining approximately constant speed for the ignition-current generator, run from an engine of widely varying speed, is unique. A Holtzer-Cabot W.S. magneto equipped with a governor pulley, is employed. The magneto, designed to run at 2,000 to 2,500 revolutions per minute, is driven by friction contact with the side face of the fly wheel rim, which varies in speed from 125 to 290 revolutions per minute, the governor acting to withdraw the pulley momentarily when its speed exceeds normal rating, so that whatever the speed of the engine, the magneto runs at approximately constant speed.

The engines are each of 90 brake horse power capacity, and use illuminating gas from the supply lines, with a heat value of approximately 600 B.t.u. per cubic foot. The engines are direct-connected to the blowers through rope flexible couplings.

A Westinghouse single-phase alternating current motor drives a 3-inch by 4-inch belted air compressor, supplying storage tanks from which air is taken to start the engines.

The value of this application of gas engines for boosting the pressure in gas transmission pipes is now quite fully realized, and boosting plants are being more extensively used. The high-pressure transmission of gas secures advantages analogous to the use of high potentials in electric power lines, availing the use of smaller pipes and increased transmission capacities.

With a gas "booster," as previously described, existing distribution systems severely overtaxed for capacity can in this way be made to adequately meet a large increase in gas consumption without further expense in piping.

---

Chapman & Walker, engineering contractors, corner Lombard and Victoria Streets, Toronto, have been awarded a contract for the instalation of a 100 h.p. electric lighting type gas engine and producer plant by City of Collingwood.

The Nichols Chemical Co., Montreal, have taken over the chemical business of the Canada Chemical Mfg. Co., London. T. H. Smallman is now a director of the Nichols Chemical Co. Albert Neighorn, formerly of the Canada Chemical Mfg. Co., now represents the Nichols Chemical Co., in Toronto, where a complete stock of chemicals will be carried.

# Correspondence and Discussion on Previous Articles

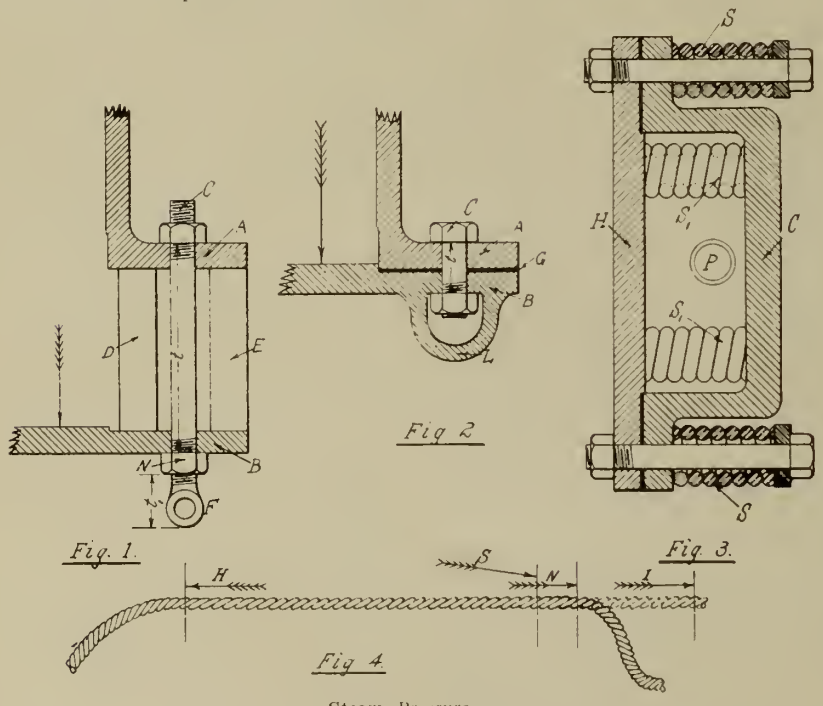
Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### STEAM PRESSURE.

Having read with considerable interest the article by Mr. Jones, as published in the September issue, relating to the tension on cylinder head studs and also the several solutions to the same in the October issue, it shows what a great difference of opinion there is among engineers upon this particular question.

While I do not hold to the idea that I am absolutely correct, I would like to bring before the readers of The Power House my views on the subject, showing to some extent that Mr. Orr is right in his opinion that the tension on the studs will increase.

Fig. 1 shows a reproduction of the




Steam Pressure.

sketch by Mr. Cariss in his solution of the problem.

Now I think if Mr. Cariss had put his excess tension in the right place his views on the subject might have been changed.

By his solution he has a tension of 1,000 lbs. on the bolt between the two nuts, which causes a compression of 500 lbs. on each of the rubber blocks D and E. Now as the tension on the bolts (between the nuts) is 1,000 lbs. shown at t, and as there is no tension whatever from the lower nut to the eye, it will readily be seen that 1,000 lbs. will have to be suspended from the eye to give a tension of 1,000 lbs. throughout the entire length of the bolt, when the pressure on the lower nut will only be the weight of the cover B and the two blocks and by removing these the nut N would be free to move, except for the stretch in the bolt thread caused by the tension of 1,000 lbs. on the bolt.

Now if this weight or pressure had been placed on the loop L of Fig. 2 or in the shape of steam, as shown by the arrow, the compression on the gasket G, would decrease in proportion to the weight or steam pressure, which is caused by the increased stretch or tension of the bolt or stud C.

In Fig. 3 is shown a sketch where the tension is illustrated by the use of springs.

If 10 springs S are placed on the 10 bolts holding the head to the cylinder, and it takes 1,000 lbs. to compress each spring close together or 10,000 lbs. to compress the 10 springs; would this same pressure compress the 10 springs on the bolts and also 10 additional springs S (or equal steam pressure) placed within the cylinder as shown.

I think myself that it would require double the pressure on the 10 bolts to compress the 20 springs, which means that the tension on each stud or bolt would be twice what it was without internal pressure.

It must be borne in mind that while there is no pressure acting on the inner surface of the cylinder there is no tension on the head or flanges; there is only the compression on the flanges and gasket caused by the tension of the bolt which has a shearing stress acting to pull the body of the bolt through the head or the nut.

To illustrate this more simply take a rope (a tug of war is a good example) shown in Fig. 4.

Let H be a man exerting a pull of 200 lbs. and another man at N exerting pull of 200 lbs., the tension on the rope is 200 lbs. Now if another man takes the rope at I. and as he gradually exerts a pull, the man at N decreasing his pull in the same proportion. By the time the man at I is pulling 200 lbs. the man at N is just holding the rope and there is still a tension of 200 lbs. in the rope. But if a man at S begins to pull, N still exerting a pull of 200 lbs. the man at H will either have to use a greater force or be pulled along over the ground.

Let H represent the head of the cylinder head bolt, N the nut of the bolt, S the steam pressure, and the rope the bolt. I represents the eye used by Mr. Cariss. As the head H and the nut N resist a pull of 200 lbs. (the tension on the bolt) any further pull or pressure in one direction as at S must be counteracted in the opposite direction, in this case at H, and as H cannot be (pulled over the ground) the tension on the bolt must increase as the force S increases.—J. H. Rogers.

---

On page 19 of the October issue of The Power House I noticed three letters in reply to a letter of "Sam Jones" in the September issue. I see two of them are of the same opinion as "Sam Jones." In reference to his question re tension on studs, the opinion that I formed myself, is the one saying that the tension is increased on the studs with each pound pressure admitted into the cylinder. I am always looking for all the information I can get along those lines and those are some points in Mr. Orr's letter which I don't quite understand. Mr Orr says in his letter that on account of the non-elasticity of the studs, the

tension on the studs will be increased with each pound of pressure admitted into the cylinder. Well, if the studs are non-elastic there must surely be something wrong with all those technical books and papers that are published, for by reading them I have always been lead to believe that if tension were increased on a bolt or stud it would be elongated, a percentage of its length depending on the amount of increased tension.

Suppose we have a cylinder and cover fitted with a ground joint, of the dimensions given in "Sam Jones" letter. A cylinder cover having an area of 100 square inches, that the steam pressure would come in contact with, is fastened onto the end of the cylinder with 10 studs, each stud screwed up to a tension of 1,000 lbs. In this case the head of each stud will exert a pressure of 1,000 lbs. on the back of the cover holding it against the end of the cylinder, or a total pressure of 1,000 x 10 equals 10,000 pounds. As the cylinder is stationary it simply acts as a stop block and prevents the cover from being moved any farther by the studs and remains so until the pressure is increased in the inside of the cover to 100 lbs. per sq. inch or 100 x 100 equals 10,000 pounds on the inside of the cover, which just equals the pressure exerted by the studs on the outside of the cover. If the pressure inside the cover is increased to 110 lbs. per sq. in. making the total pressure inside the cover 110 x 100 equals 11,000 pounds, the studs will be elongated a little allowing the cover to ease back from the end of the cylinder, relieving any pressure that might have been exerted between the cover and the end of the cylinder. The tension on each stud would then be 1,100 pounds instead of 2,100 pounds as Mr. Orr says it would be.

Now let us work out the theory that the tension is increased with each pound pressure admitted into the cylinder. If we take the same question that is under discussion, and we screw 1,000 lbs. tension on each stud, the studs will be elongated a percentage of their length. Let us increase the tension on each stud 800 pounds more, or 8,000 pounds on them all, they will be elongated a little more. Now instead of screwing 800 pounds extra tension on each stud, we leave the original 1,000 pound tension on each stud and we admit 80 lbs. per square inch or 80x100 equals 8,000 pounds into cylinder. Now if the tension is increased on the studs as Mr. Orr says it will be, the studs will be elongated in this case just the same as in the other, and if the studs are elongated, the cover will be eased off the end of the cylinder, then the original tension on the studs will be relieved, leaving only 800 pounds ion eacn stud, which cannot be until the pressure admitted into the cylinder over-balances the pressure exerted on the outside of the cover by the head of the studs.

JAS. SWANSON.

## COLD WATER DELUSION.

The article "Cold Water Delusion," noted in October number, as you state in your foot-note the safest plan (at least with brick set boilers) is to deaden or draw the fire if the water gets below the bottom connection of water column. But I haa an experience some years ago which proves that even a brick set boiler can be filled with cold water when the brick work is practically red hot and no serious rupture occur at the time. The incident mentioned really occurred. The engineer in charge at that time is still in charge. The thing which did happen was slight cracks in the plates near the stay ends caused by unequal contraction. This would not cause any danger while the boiler was being filled, but would be very dangerous indeed after steam pressure was raised in the boiler.

JAMES E. NOBLE.

I read with a great amount of interest the subject on "Cold Water Delusion." I will give you my idea of just what should be done in the event of water being low. Suppose owing to the breakdown of the pump or injector, or any other cause, the water should get so low as to disappear in the glass gauge and lowest gauge cock, and you had no means at hand with which to get more water into the boiler, what would you do ?

If the fire was a light one, have it out at once, but if a heavy one cover it over with ashes, fresh coal, or anything come-at-able. Then close the dampers, open furnace doors, and let the boiler cool off and the steam pressure fall. While this is going on overhaul pump, injector, or whatever caused the trouble, and in about an hour, more or less, fill up with water again, raise steam and go ahead. Then the question comes, would you raise the safety valve ? I should say not. Touch nothing and do nothing except just what has been said. In such an emergency it is dangerous to "monkey" with the safety valve.

## ONTARIO LICENSE LAW.

Please find enclosed $1 for subscription to The Power House. I think your paper should be in the hands of every engineer who would wish to make headway in his profession. As an instructive educator The Power House is certainly in the front rank. It is a welcome visitor with me.

Re the License Law of Ontario. As far as this district is concerned, there are a number of large boilers in operation and I doubt if there are licensed engineers in charge. Would you be kind enough to tell me if, say, a boiler of 70 horse power, for heating a large block in the winter time, not carrying very high pressure, should have a man in charge with a license.

FRED NAGLE.

The license law does not apply to any steam plant having a capacity of less than fifty horse power, nor to steam heating plants operating at a pressure of twenty pounds or under.—The Editor.

## SAFETY VALVE

I would be glad to receive through The Power House an answer to the following question. If an engineer had two safety valves both set to blow at 120 pounds and put one on the discharge of the other, what pressure would need to be on the boiler to make the top one blow. You will probably think this a foolish question but I understand it is a state license law in the United States and we have had quite an argument over it.

SUBSCRIBER.

The first safety blows at 120 lbs. As soon as the temperature equalizes, the second safety valve blows at 120 lbs. though not simultaneously with the first. The difference in the time depends on the length of pipe, radiation, etc.—Editor.

## FEED WATER TREATMENT.

I have been troubled with sediment in the feed water and a heavy scale in the boiler. Will you give me some information how to eliminate the trouble ?

READER, SUBSCRIBER AND OTHERS.

Several letters have been received with substantially the same question, all subscribers, and all referring to one or more of the advertisements in The Power House, one went so far as to say that he had used compounds. That is just the trouble. When an operator or proprietor of a power plant decides to use a compound he becomes "penny wise and pound foolish" wasting his money on "stock" compounds.

The subscribers should not only read the advertisements but go a step further and write the boiler compound advertisers in The Power House. Any one of them are companies with a reputation who deal, not in stock compounds, but treat the feed water scientifically. It is known that water varies and a prescription that will suit the water in Alberta will not suit the water in Ontario.

Anyone desiring to have the feedwater properly treated should send a clean bot-

tle of the water to the chemist. An analysis of the scale will not give the proper analysis of the sediment in the water, as different substances precipitate at different temperatures. Therefore send a quantity of water and your instructions will secure prompt attention. Read the advertisements as you have done, and then go another step further, answer them, and you will obtain information from the manufacturers that will be of great use to you.—The Editor.

## CAPACITY OF A DYNAMO.

Having seen Mr. Leslie's enquiry in The Power House, I enclose the following formula which I think is a good one.

Rule : The capacity in 16-candle power lamps is equal to the capacity of the dynamo multiplied by 1,000 and divided by 60.

The power used in a 16 candle-power lamp is 55 watts, but there is always a small loss in the feeders, so that the power for a lamp is taken as 60 watts.

The last part of the inquiry is more difficult to answer. A kilowatt equals 1,000 watts. A 16 candle-power lamp takes a power of 55 watts at 110 volts, so that in this case the number of watts per candle power is 55 divided by 16 or 4.4 watts. If the voltage of a lamp is increased, the number of watts used per candle-power is decreased. The life of the lamp is also decreased. If the voltage is decreased the effect is reversed. In this case the amperage required per candle-power follows Ohm's law. That is :

The current will have to be increased if the voltage is decreased, to produce the same power or light, and if the voltage is increased, the amperes needed is decreased.

A. R. WELLS.

On page 41 of the Sept. Power House I see a short letter from one Pat Lavelle, who advocates a uniform engineers' license law for the Dominion, and to it I wish to say "Amen."

On page 42 I also see a letter from L. P. Leslie containing two questions. 1st. "What is the capacity in 16 candle-power lights of a dynamo of 2½ k.w. power at 110 volts ?" Ans.—15.

2nd. "Does a k.w. furnish a candle-power regardless of voltage and amperage ?" Ans.—1 k.w. furnishes 288 candle-power and voltage must be same as that for which the lamp being used was built. The "volt" is a term quality or strength and the "ampere" is a term of quantity or amount. Therefore we may have 10 amperes of electricity 110 volts strong or 90 amperes of electricity 60 volts strong, etc., etc. Now 1 ampere of current at 1 volt of strength equals 1 watt. Therefore 1 ampere at 8 volts would equal 8 watts; 2 amperes at 8 volts would equal 16 watts ; 8 amperes at 2 volts would equal 16 watts ; 1 ampere at 110 volts would equal 110 watts ; 50 amperes at 110 volts would equal 5,500 watts. Always the voltage X amperage equal watts. Now 1,000 watts equals 1 k.w. no matter of what voltage or amperage the watts are made up, and 746 watts equals 1 h.p.

A 2½ k.w. dynamo will generate 2½ X 1,000 equal 2,500 watts. 2,500 watts at 110 volts would give 2,500 divide 110 equal 22 8-11 amperes as the capacity of the machine. A new 16 candle-power lamp uses practically ½ an ampere at 110 volts, so that 22 8-10 amperes would supply 45 of them. One k.w. will therefore supply eighteen 16 candle-power lights at 110 volts.

R. MANLY ORR.

## WATER POWER PROBLEMS

I live in a town where there is considerable water power used and as a reader of your paper I would be glad to have you tell me a simple way of getting at the horse power of a stream and the amount of water required to develop a certain horse power.

HYDRAULICS.

The theoretical horse power is found by multiplying the amount of water in cubic feet per minute by the weight of a cubic foot and by the height of fall in feet and divide by 33,000. This last is, of course, the number of foot pounds per minute equivalent to one horse power.

$$\text{Thus H.P.} = \frac{62.4 \times Q \times H \times 60}{33{,}000}$$

Where H.P.=Theoretical horse power.
Q.=Quantity of water in cubic feet per second
H.=Height of fall in feet (head).

The word theoretical is used because the actual horse power is dependent upon the amount of friction in the pipes and curves and upon the efficiency of the water wheel or turbine which is to turn the fall into available power. The theoretical quantity of water per second necessary then for any horse power is found by transposing the above formula. thus:

$$Q. = \frac{\text{H.P.} \times 33{,}000}{62.4 \times H \times 60}$$

The loss of head due to friction and the efficiency of the wheel must also be considered in this case.

The loss of head due to friction may be found by the use of Cox's formula which is:

$$FH = \frac{L}{d} \times \frac{V^2 + 5V - 2}{1200}$$

Where L=Length of pipe in feet.
V=Velocity of water in feet per second.
d=Diameter of pipe in inches.
FH=Friction head in feet.

It will be noticed that the friction loss is independent of the pressure or head of water in the pipe.

## PIPE COVERING.

In reading a letter in the February number of Pipe Covering in Canada, by H. C. Morris, I noticed a few points that seemed to be not just exactly correct. In the first place, he refers to mineral wool. I have used mineral wool, 85 of magnesia, and hair felt, and experience, I must confess, has given mineral wool a hold on me. A few days ago I invited a very capable engineer to put his hand on pipes covered with different coverings. Of one he said, "That is good, the best I ever felt." On telling him that it was mineral wool, he replied that it was certainly all right, and that he had never seen it used before.

It is efficient and apparently durable. It can be removed and applied again, but there is no doubt a limit to the number of times this can be done. There is a limit to the durability, or number of times, almost any pipe covering can be handled.

Hair felt is a slightly better insulator than mineral wool, but is inflammable and it is necessary to keep it from direct contact with the pipe. Last summer I moved some of it from some pipe and put it on other pipe, first covering the pipe with two or three thicknesses of asbestos paper, applied so as to have lots of wrinkles. It had been on for several years and was slightly charred in some places.

Mr. Morris says that heat is taken away from pipes and other heated surfaces by the circulation of the air and not by radiation. Prof. Kent, on the contrary, says, that radiation of heat takes place between all bodies at all distances apart, and allows the laws for the radiation of light, that is, the heat rays proceed in straight lines and the intensity of the rays radiated from any source varies inversely as the square of their distance from the source. The coverings recommended by Mr. Morris make a very neat-looking job, but asbestos enters largely into their construction, and every engineer knows that asbestos is a notoriously poor insulator, in other words, it is a good heat conductor.

Prof. Kent says of it: "Asbestos, with exceedingly fine fibre, made a somewhat better showing (than a sample of coarser fibre), but asbestos is really one of the

poorest non-conductors. It may be used advantageously to hold together other incombustible substances, but the less of it the better.''

Mr. Morris and Prof. Kent differ also on the moisture in steam, Mr. Morris claiming that the moisture in steam at 80 pounds pressure equals 10 per cent., and at 120 pounds, 1.7 per cent. Prof. Kent gives the moisture at 80 pounds as 3.86 per cent., and at 120 pounds 4.85 per cent., which looks more probable.

Mr. Morris claims a saving for air cell over bare pipe of 74 per cent., that is, there is a loss of 26 per cent. with air cell of what there would be with bare pipe. That is probably very good for asbestos, but mineral wool wastes something like 10 per cent..

Mineral wool, then, in the example he cites, would show a saving of about 553 tons. This would be 184 tons better than air cell, and at $4 per ton would be about $736 better than air cell—a nice little sum that would go a long way toward paying for a good covering. The saving in labor and engine and pipe must also be considerable.

Asbestos sponge felt, according to Mr. Morris' figures, appears to be a very efficient covering and ought to be tested by some reliable authority and the result made known. We can't have too good a covering, but it costs money to experiment, and the best way is for one experiment that we can depend on to be made for all of us.

R. McLAREN.

## TRIPLE EXP. ENGINE CARDS.

I beg to submit the enclosed combined diagram of the cards taken by John C. Tweedale from his triple-expansion engines and published in the September issue of The Power House. In computin the I.h.p. it is, no doubt, easier to assume the work all done in the low pressure cylinder and to reduce the pressures to the area of the low pressure cylinder, as Mr. Tweedale says, but, it is necessary to find out what each cylinder is doing in order to balance the work between them.

In figuring out the equation

$$\text{I.h.p.} = \frac{37 \times 6 \times 4{,}071.51 \times 62}{33{,}000} = 1{,}334.55 \text{ I.h.p.}$$

Mr. Tweedale has apparently made a mistake, I make it 1,698.18 I.h.p.

In running over the cards with a Willis Planimeter, I find the m.e.p. of the H.P. cylinder, 81.5 lbs. per sq. in.; of the I.P. 28.75 lbs. per sq. in., and of the L.P., 15.125 lbs. per sq. in. The I.h.p. of the H.P. cylinder then, from the formula,

$$\text{Plan} \quad \text{I.h.p.} = \frac{81.5 \times 6 \times 615.75 \times 62}{33{,}000} = \frac{\quad}{33{,}000}$$

565.7 I.h.p.; that of the

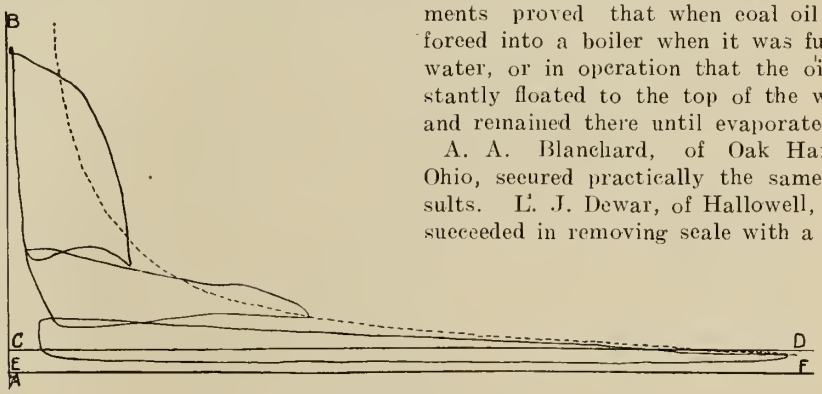
$$\text{I.P.} = \frac{28.75 \times 6 \times 1{,}520.5 \times 62}{33{,}000} = 492.32 \text{ I.h.p}$$

and of the

$$\text{L.P.} = \frac{15.125 \times 6 \times 4{,}071.51 \times 62}{33{,}000} = 694.19 \text{ I.h.p.}$$

or a total of 565.7+492.32+694.19= 1,752.21 I.h.p. This shows an unbalanced load of 694.19—492.32=201.87 I.h.p. between L.P. and I.P.; 694.19—565.7= 128.49 I.h.p. between L.P. and H. P. and 565.7—492.32=73.38 I.h.p. between H.P. and I.P.

The ratio of pressures (m.e.p.) in the different cylinders should be the same as the cylinder ratios, viz., if the valves were adjusted to equally distribute the load, with the m.e.p. of the H.P. 81.5 lbs., we would get 81.5÷2.46=33.13 m.e.p. for the I.P. and 81.5÷6.61=12.33 m.e.p. in L.P.; lengthening the cut on the L.P. and shortening it on the I.P. should do this. By lowering the compression in the H.P., he would do away




Triple Expansion Cards.

with the objectionable loop altogether. In the combined diagram A.B. is the clearance line, C.D. the atmospheric line and E.F. the vacuum line, the dotted line being the theoretical expansion or isothermal curve. In conclusion I may say that I am very much pleased with The Power House and congratulate you on the progress you have made, including the advertisements which are instructive to the engineer.

J. S. B. PHELPS.

## USE OF COAL OIL IN BOILERS.

I note in the leading article in October number that G. C. Keith does not recommend coal oil as a scale remover. I have read letters in the Canadian engineering journals, from time to time, from engineers who recommend its use and in some cases they state positively that it will remove scale. Perhaps it will under certain conditions, but in the very few cases that it apparently does good work, it is probably due, or largely so, to the fact that most engineers when making experiments of this kind are more careful in operating, they blow down oftener, etc. If an engineer is determined to use coal oil he should use it in the crude form before it has passed through the purifying process. There is a very large amount of evidence gained by practical and experimental tests, which apparently prove that coal oil as a scale remover or preventer is an absolute failure, and in the hands of a careless engineer a dangerous article.

J. C. Mellen, of New York, at one time was a believer in coal oil purge until he started some practical experiments when he found that it would not remove scale from a boiler whether applied drop by drop, or in bulk, whether it was put into an empty boiler and the water raised, or put into a boiler in operation. He removed a scaled boiler tube and kept one of the scaled ends covered with coal oil for twelve months and, at the end of this time, the scale was just as hard and had just as firm a hold onto the tube as in the beginning. His further experiments proved that when coal oil was forced into a boiler when it was full of water, or in operation that the oil instantly floated to the top of the water and remained there until evaporated.

A. A. Blanchard, of Oak Harbor, Ohio, secured practically the same results. L. J. Dewar, of Hallowell, Me., succeeded in removing scale with a mixture of coal oil and caustic soda. Probably the scale was caused by bicarbonates of lime or magnesia, which the caustic soda alone would have removed. It is possible that there is one certain kind of scale which coal oil will remove, but up to date it has not been discovered by the men who experiment a great deal along this line in engineering practice. One of your correspondents asks about the effect of blackstrap syrup on boiler scale. I could not say what effect it would have on the scale, but I would imagine it would be a good thing to remove part of the boiler plate by corrosion, as the action of the heat on the blackstrap will tend to liberate the acid in it, which in turn may attack the iron.

JAMES E. NOBLE.

The Colonial Engineering Co., Montreal, are installing complete gas engine power and lighting equipment in the Jacobs Bldg., Montreal. They are also installing in Montreal a demonstration gas engine pumping equipment, which will show a high efficiency.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power and to the operation of Refrigerating Machinery.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* — *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726 F. R. Munro
BRITISH COLUMBIA Vancouver R. Bruce Bennett 1737 Haro St.

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
NEW YORK - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone 1111 Cortlandt

**PARIS**
FRANCE - John F. Jones & Co., 31bis, Faubourg Montmartre, Paris, France

**SWITZERLAND**
ZURICH - - Louis Wolf Orell Fussli & Co

Cable Address:
Macpubco, Toronto - Atabek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II NOVEMBER, 1909 No. 11


## CONTENTS


The Campaign in Canada for Uniform Boiler Laws - - - - - 21
Best Form of Longitudmal Joint for Boilers - - - - - - 22
Wind—Electric Power - - - 22
Mechanical Refrigeration and Its Principles - - - - - - 23
Cost of Water Power Plant - - 24
Corliss Engine for Kew Beach Sewage System at Toronto - - - 24
Venturi Meter for Hot Water Work and Boiler Feed - - - - 25
B.C. Electric Work in Vancouver - 26
Crude Rubber: Its Varied Manufactured Products - - - - - 27
Training Naval Engineers . - - 28
Inglis 15,000,000 Gallon Pump and Engine - - - - - - 29
Annual Social Gathering of Toronto No. 1 Lodge, C.A.S.E. - - - 30
A Chapter of Steam Boiler Explosions—Probable Causes - - - 32
Practical Points in Regard to Motor Brushes - - - - - - 35
The Cost of Hydro-Electric Power - 36
Some Recent Meetings - - - 37
Coming Meetings - - - - 37
N.S. Society of Engineers - - - 37
A Refrigerating Turbine - - - 37
Practical Articles by Our Readers - 38
Lifting Water From a Depth Greater Than 34 Feet With an Ordinary Suction Pump.
Oil Filter; Saw Dust.
Laberatory Analyses Versus Boiler Tests.
Forcing Capacity of Boilers.
Experiences of the Road.
Definition of Kilowatt.
Engine Speed Regulation and Tungsten Lamp.
Novel Use of Gas Engines for Boosting Gas Pressures in Transmission Pipes.
Correspondence Discussion on Previous Articles - - - - - - 42
Steam Pressure.
Cold Water Delusion.
Ontario License Law.
Safety Valve.
Feed Water Treatment.
Capacity of a Dynamo.
Water Power Problem.
Pipe Covering.
Triple Exp. Engine Cards.
Use of Coal Oil in Boilers.
Editorial - - - - - - - 46
New Equipment for Power Plants - 48
Westinghouse Leblanc Condenser.
Richardson Sight Feed Oil Pump
Differential Water-Pressure Steam Trap.
Boiler Feed Water - - - - - 50
Setting the Valves of the Brown Automatic Engine - - - - - 51


## CERTIFICATE RENEWALS.

The time has arrived for each Ontario engineer to think of the renewal of his certificate. In this connection we wish to quote a paragraph from a pamphlet issued by the Stationary Engineers' Board, Parliament Buildings, issued January 1, 1909. This is as follows:

> "Every certificate holder who intends to renew his certificate should register with the Board not later than the first day of December of each year on a form which will be supplied. A certificate holder who has not registered by the first day of February next ensuing will be granted a renewal only on the payment of a fee of five dollars."

It will, therefore, be seen that immediate attention must be given to this matter, if the engineer wishes to escape the $5 payment. In order that this matter may be brought to every engineer holding a certificate, a letter, over the signature of W. C. McGhie, chairman Stationary Engineers' Board, with an addressed envelope, has been sent to each one. This letter reads as follows:

> "In accordance with the Stationary Engineers' Act, the renewal fee for your 1910 certificate is one dollar ($1.00), which must be paid not later than the 31st day of December, 1909.
>
> "You will kindly fill out the enclosed slip and return with one dollar (cash preferred) in addressed envelope."

Prompt attention by the engineers will be appreciated by the board, and requests for renewals will be dealt with by them as received.

## SECRET COMMISSIONS ACT.

There seems to be doubts in the minds of some as to the application of the Secret Commissions Act. It was thought that this act referred only to the civil service. While it is a copy of the English act and was introduced on account of the secret rebates exposed in the investigation of the marine department of the civil service in one of the provinces, for the purpose of preventing such occurrences in future, we understand it was first passed in England to prevent buyers going to London and getting a secret commission from the houses they bought from while in the employ of the houses for whom they bought.

Manufacturers will be interested in knowing that the Secret Commissions Act refers to ordinary business transactions as well as to the civil service.

The following letter from the Clerk of the Parliaments, Ottawa, gives a brief history of the bill:

"It was introduced into the Commons on 1st February, 1909. Passed by House of Commons, 23rd February; received by the Senate on 2nd March; amended by Senate on 24th March; returned to Senate with amendments agreed to 21st April; assented to 19th May."

The amendment referred to is the principal feature of the bill which makes it general in its application. It reads:

> Every person who is a party or knowingly privy to any offence under this act shall be guilty of such offence and shall be liable upon conviction to punishment hereinbefore provided for by this section.

This, according to the best of authorities, makes the traveler or manufacturer guilty of a breach of the act.

### Importance of the Act.

The following letter from a prominent Toronto business man illustrates the importance of the act:

> To the Editor of The Power House.—In the October issue of your journal you reprint and call attention to the above-mentioned act, which was passed at Ottawa last session. This piece of legislation has not received the attention that it deserves, and, in fact, is almost yet unknown, as a law, to the great majority of citizens of the Dominion. You are undoubtedly doing a great public service in bringing this act before your readers, and it is to be hoped that other publications will follow your good example. All papers should freely comment upon it. It is a case where the necessity of such a law being properly observed should be "**pounded in**" **everywhere.**
>
> Too much publicity cannot be given to the fact that our corrupt business methods have forced such legislation, and in response the act has been

brought into existence and stands upon the statute book, with the severe penalties therein prescribed for infraction of same.

Attention should be called to the alarming increase in the petty bribe and graft custom in our business life in Canada; in this particular we seem to be following closely the regrettable usages of our neighbors south of the line, although the Old Country is not a stranger to it.

This matter is more important and far-reaching than is generally supposed; in some lines of business it amounts almost to blackmail. Some Government and municipal employes look for a commission, and trade is only secured through this channel; purchasing agents in large concerns have to face it, and in some cases suggest it; many engineers are "fixed" to report on oils, etc., and qualities and quantities used, as well as prices made, are in accordance with the "fixing" regulations; printing inks and various other supplies are thus often bargained for. In fact, this dishonest and debasing process runs through so many avenues and lines that it is impossible to enumerate them. It destroys all fair competition and is utterly demoralizing to the individual and the nation.

In the interests of common honesty, business integrity and good citizenship, this abuse should be stamped out. It curses "him that gives and him that takes."

TORONTO BUSINESS MAN.

We believe this act to be to the interests of business men, and it is hoped everyone will assist in its enforcement. The Power House intends giving publicity to everything which will place the engineer and the manufacturer on a higher plane. We believe the enforcement of this act will do this and assist in the building up of honest men who can be trusted to do the right thing wherever they are employed.

## FROM US TO YOU.

We (the editors of The Power House) would very much like to have a ten-minute chat with each and every one of our readers at least twice a year. We want to do this because we want you to get confidential and tell us how you like the paper, what you would criticize about it, etc. It is in this way (and, we believe, only in this way) that we can make The Power House indispensable to you.

The trouble is that if each of you were to pass through our office, stopping only for ten minutes, it would take over three months to go from A to Z, and in the meantime where would "The Power House" be? So what we want you to do is to sit down some evening when you have ten or fifteen minutes to spare and write us a letter containing your views, criticisms, etc. Call us down, if you think we need it. It will probably do us both good—you, to get it out of your system, and us, to have our weak spots shown up. Sometimes, you know, editors like us are apt to get the idea that our paper is just about perfect, when in reality there is loads of room for improvement. We will admit that we do think The Power House IS a pretty good paper for its field, but it can be made much better and we want your help.

If you don't want your letter published, say so, and that settles THAT question. If you have any ideas about power plant management, labor-saving dodges, emergency repairs, etc., tell us about them, because we pay real money for those sort of letters.

Another thing: If you are interested in any line of packing, belting, engines, boilers, valves, etc., write to The Power House advertisers and get their catalogues. They will be glad to send them if you mention The Power House, and a good library of up-to-date catalogues is a mighty good thing to have. They generally contain a fund of useful information that every engineer and those in charge of power plants should have at hand. It's cheap information, too—only a two-cent stamp and a few minutes' time per catalogue.

But, whatever you do, we want you to write to us about The Power House. We are making a frank confesion to you, that we are aware of the room for improvement, and we reiterate: we want your co-operation. After all, it is the readers' co-operation that makes or breaks a paper. You pay for the publishing indirectly, because you make it pay the advertisers to use our columns, and therein is the paper's revenue. So, you see, we are anxious to "get in right" with you, and the only way for us to know when we have reached this stage is to have you tell us (without gloves on) when and how we are in wrong. Won't you?

## AN EXPORT BUREAU.

An export bureau is being established by the Trade and Commerce Department at Ottawa, for the purpose of encouraging and facilitating export trade. It is proposed to establish a list of Canadian manufacturers and others who desire to extend their trade to Great Britain and foreign markets. Circulars are being sent throughout Canada inviting such firms to send in their names and lists of articles they are in a position to sell abroad. With this information the Department of Trade and Commerce will be in a position to supply it to its agents, of which it has six in Great Britain, one in France, two in South Africa, one in Mexico, one in the West Indies, two in Australia, one in China, one in Japan, one in Holland, and one in Newfoundland.

Nothing of this kind has ever before been attempted in Canada, and it will entail great labor in the department in indexing the information to make it readily available when required. But it is to be hoped that it can be made the basis of a permanent list which will be immediately available at all times in the advancement of the foreign trade and commerce of Canada. The department desires the name of every exporter from the Atlantic to the Pacific, with a detailed list of the goods they are in a position to sell abroad.

## TRAVEL ON YOUR OWN POWER.

The force that is going to carry you to your goal is coiled up inside you—in your energy, your pluck, your grit, your determination, your originality, your character, says Dr. Marden, in an article to young men on "The Precedent Breaker." Further, he says:

"The sooner you become disillusioned as to getting any great assistance outside of yourself, and fall back upon your own inherent force, the better.

"It is a pitiable thing to go through the world borrowing other people's ideas, plans, methods; other people's judgment—running to this one and that for advice—never developing your own power, independence, self-reliance.

"Originality is force, life; imitation is weakness, death. There is nothing else which will kill the creative faculty and paralyze growth more quickly than imitating others, following precedent in everything, and doing everything in the same old way."

# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### WESTINGHOUSE LEBLANC CONDENSER.

The Leblanc Condenser which has been placed on the market has many good features, including compactness and simplicity, which are evident from Fig. 1, which shows the condenser, turbine driven. The condensing chamber is of small diameter, being but slightly larger than the exhaust opening of the engine, and another good feature is the provision for separate removal of water and air. This is performed by a pair of small turbine-type motors on a common shafe, inclosed by a single-unit casing which is integral with the lower portion of the condensing chamber. A general sectional view of the standard Westinghouse-Leblanc condenser is shown in Fig. 2. The exhaust steam enters the chamber D, and cooling water entering through pipe A is projected downward through spray nozzles B. The injection water and condensed steam flow to the centrifugal discharge pump M under a head of 2 or 3 feet, which insures positive filling of the pump. The exhaust steam is drawn downward and condensed by the water spray. The space E above the water is occupied by water vapor plus the air released from the injection water and from the exhaust steam. This space communicates with the air pump N through pipe K. A detail of this pump is shown at the right in this illustration.

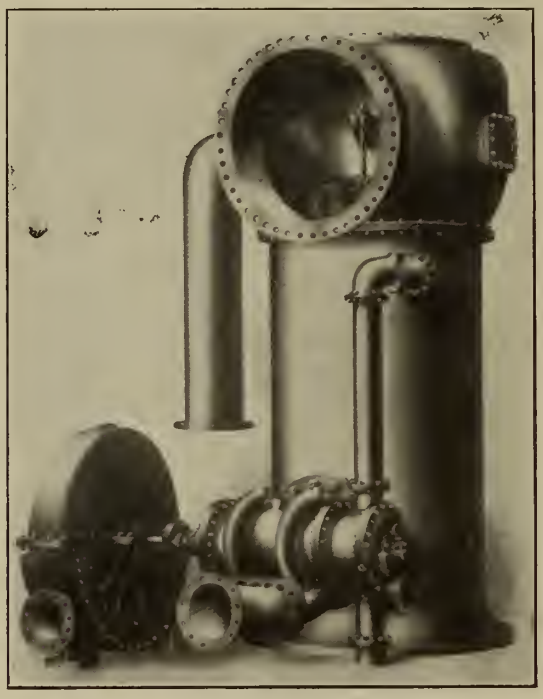


Fig. 1.—Condenser, Turbine Driven.

The principle of the air pump is entirely new. The pump projects a series of water pistons through the discharge nozzles, each one of which forces ahead of it a small pocket of air. The air mingles with the water in the lower portion of the nozzles, but the speed is such that no part of it ever finds its way back toward the condenser; in other words, there is no leakage past the pistons. The initial pocketing of the air between the successive layers of water is positive, so that the neutralizing effect of clearance is eliminated. The water supply for the air pump may be taken from the main water inlet, or a supply may be placed in a tank and used over and over. Since the air-pump water is in communication with the condenser, it is drawn by suction into an annular chamber G, which is overhung by the buckets of the pump rotor. The water passes out of the chamber through the port H and is projected downward in a rapid succession of water pistons. At the lower end of the air-pump nozzle is placed an auxiliary ejector nozzle L to which is connected a steam pipe. In starting up the condenser, steam is turned into this auxiliary nozzle for a few moments, thus creating sufficient vacuum to start the regular flow of water through the air pump. Where the level of the cold well is 3 or 4 feet above the basement floor, the air pump may be started without the use of steam. As will be noted in Fig. 2, the air-pump rotor and the main-pump runner are inclosed in a common casing and mounted on the same shaft. There are only two bearings and the shaft glands are made airtight by the water seals. The air and centrifugal pump impellers are shown to advantage in Fig. 3.

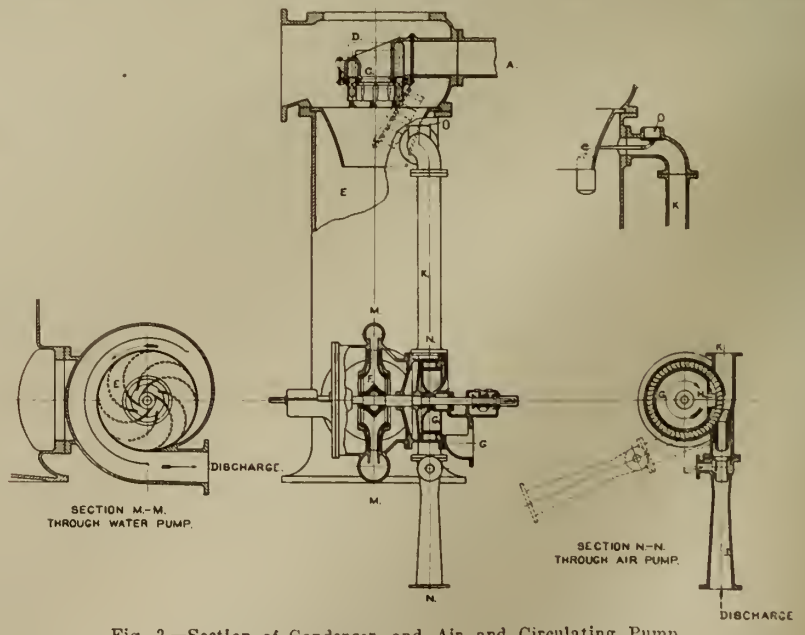



Fig. 2.—Section of Condenser and Air and Circulating Pump.

Usually the pumps are driven by a

Westinghouse steam turbine, and under ordinary conditions require from 2 to 3 per cent. of the power generated by the main engine. The exhaust from the condenser turbine is utilized for heating feed water. In cases where economizers are used, or where there may be extra sources of exhaust steam, it is advisable to operate either the condenser pump or the exciter by means of an electric motor. The main pump is commonly designed to discharge against only a few feet head sufficient to overcome friction in the discharge line. If it is desired to elevate the water to the top of cooling towers or other moderate elevations, the pump can be modified to meet the additional duty.

For units smaller than 300 horsepower, it is customary to eliminate the main condensing chamber and pass all the exhaust steam as well as the air through the air pump only. For this service the air pump is slightly modified, a relatively greater amount of water being used, which serves both to expel the air and condense the steam in one operation.

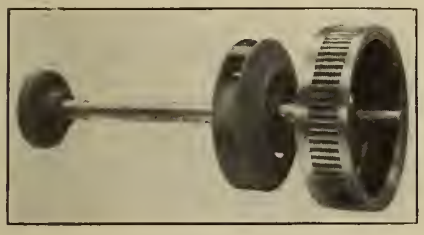


Fig. 3.—Pump Propellors.

For use with surface condensers, both stationary and marine, and for application to barometric and other types of jet condensers, evaporating pans, etc., the air pump is furnished separately. In the case of new installations of surface condenser, the air pump and the circulating pump may be combined in a single compact unit substantially as shown in Fig 2.

The Westinghouse-Leblanc condenser is manufactured by the Westinghouse Machine Co., Pittsburg, Pa.

## RICHARDSON SIGHT FEED OIL PUMP.

The accompanying illustration shows a model "C" lubricating oil pump on a horizontal Corliss engine. It is built for one or two feeds, the illustration showing one feed pump. Glass tanks are supplied with different capacities.

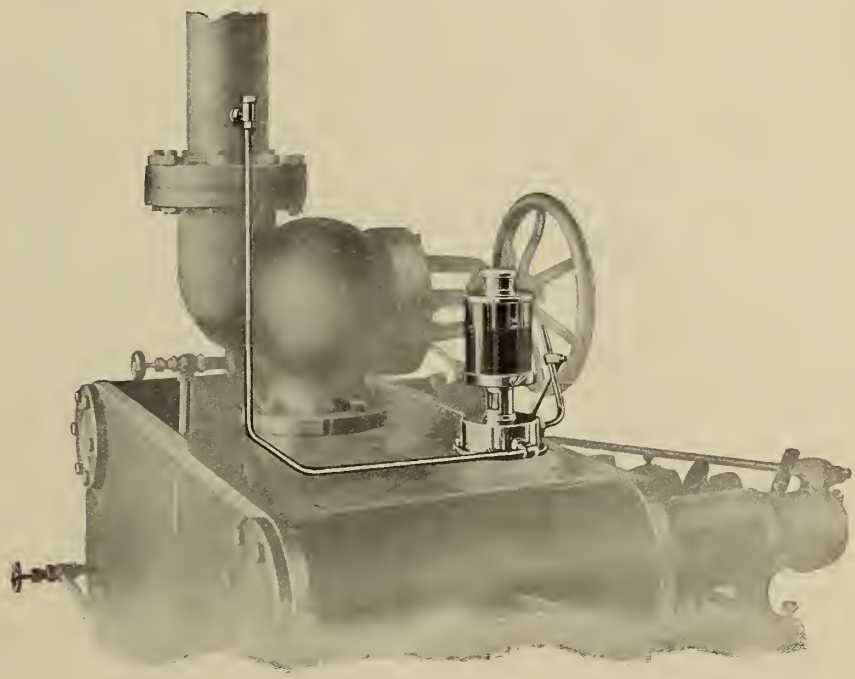
At the top is a large opening for filling, with a good strainer and a substantial cover so fastened so that it cannot be mislaid or lost. The feed valves are on the side of the pump near the bottom, convenient to get at, and in plain view.

The valve seats are so arranged that dirt will not lodge thereon, and an opening in the bottom so that the tank can be easily cleaned.

In the base is a steel polished plunger for one feed, or for two feed, with a rack engaging gear on the combined shaft and lever, the latter removable for adjustment at any angle by backing out the follower.

To compensate for inevitable wear, hard babbit cones form the working chambers, which can be compressed to renew the fit by forcing them in with the screw valve cases. To insure permanent tightness, valve with hardened steel valves and bevelled seats that can be quickly re-ground are provided.

The oil drops through an air-tight, glass enclosed chamber in which the rate of feed is clearly visible. When the



Model C. Feeding Horizontal Corliss Engine.

oil pump stops, a small amount of oil will continue to all, forming the necessary excess for starting.

The pumps are manufactured by the Sight Feed Oil Pump Co., Milwaukee, Wis.

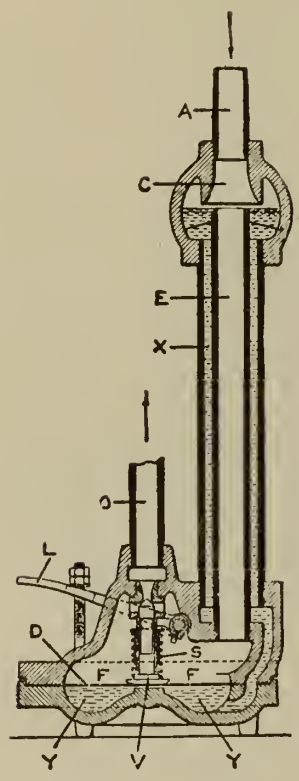
## DIFFERENTIAL WATER-PRESSURE STEAM TRAP.

This trap depends for its working upon the principle of differential water pressure, that is, to the difference of pressure due to two unequal columns of water acting upon the opposite faces of a flat diaphragm, the motion of which controls the valve. It is the invention of R. J. Flinn, West Roxbury, Mass.

The illustration shows a sectional view through the working parts of this trap, which consists of two wrought iron pipes of different diameters, the smaller one being placed inside the larger. At the lower end of these pipes is a cast iron shell, divided into two compartments, F and Y, by a flexible diaphragm D. The contents of the larger or outer pipe communicate with the bottom compartment Y, bounded by the under side of the diaphragm, whilst the smaller or inside pipe communicates directly with the compartment F on the upper side of the diaphragm. In the latter compartment the valve V is clearly seen, being held against the diaphragm by the light spiral spring S, the tension of which may be adjusted by means of the lever L, and the lock nuts on the screwed stud on the outside. The upper end of the external tube supports the inlet chamber C, which is of a globe-shaped appearance, having a peculiar inverted funnel-shaped entrance, by which means the incoming water is distributed to the best advantage for the proper working of the trap.

The action of the trap is as follows: Water of condensation entering at A, follows the surface of the funnel, and is thereby directed to the lower chamber Y, through the annular space between the two tubes, until the latter is completely filled, when it overflows into the chamber F by way of the inner tube. Now, when this inner tube is about half full, the diaphragm is in a state of equilibrium; the pressure on the bottom or under surface due to the column of water X just balancing that on the top or upper surface, due to the pressure of the valve spring S, together with that of the column of water in the inner tube; under these con-

ditions the valve is on the point of opening. The outer column of water acting on the underside of the diaphragm tends to hold the valve hard on its seat, whilst that in the inner tube, together with the action of the spring, tends to drag it off, so that it is clear that when the two equal and opposite forces exactly counterbalance each other, it is only necessary for the incoming water to add to the head in the inner tube, in order that the valve may be made to leave its seating and allow a discharge to take place, until the head in the inner tube has fallen to a level, approximately a little below the middle of the pipe E. This level may be called the "water seat level," for the valve opens every time the water rises above this level, and closes every time it falls below it. So that the discharge is entirely controlled by



Section of Flinn Trap.

the quantity of water needing ejectment —a very important feature.

It will be recognized at once that the great simplicity arrived at in this trap is entirely due to the fact that the controlling forces are in no way whatever dependent upon either the temperture or the pressure of the contents of the system being drained ; for the pressure may be anything from 1 lb. to 300 lbs., and the trap will work equally well with but one adjustment.

One feature which cannot be passed without special mention is the absolute protection afforded the valve whilst working, for nothing but water can pass it, owing to the fact that before steam can appear the water level must fall to the bottom of the inner tube, which is practically an impossibility as long as the trap is in working order.

The lever L shown in the illustration has a two-fold function ; firstly, it may be employed to adjust the pressure of the spring S, so as to either raise or lower the water seal level ; and secondly, it performs the all-important function of a simple and handy blow-through lever.

## CORRECTION.

In the article "Jack tells Jim how to find the height of a smokestack," in the October issue, the conclusion should read as follows : "Then the triangles ABC and ADE being similar, AB : BC:: AD : DE and DE+FD equals FE, the height you want."

## BOILER FEED WATER, ETC.

Will you please allow me to express an opinion regarding a few things which appeared in the October issue of The Power House. To begin with the article under "Boiler Feed Water and its Treatment"—Pitting—by galvanic action is said to be the result of the chlorides in the feed water and the carbon in boiler plates forming a galvanic battery and the carbon is eaten away. Seeing that in any galvanic battery the substance consumed is always the one having the highest heat value (iron has a higher heat value than carbon) it would seem that iron would be eaten away before carbon. Carbon is also lower in heat value than copper, therefore brass connections on water column or fusible plugs (part brass) or any brass connection below water level would be more likely to be attacked by galvanic action than the carbon in the shell. Has any engineer any proof that zinc plates have really done any good in a boiler ?

Next under the heading "Unique Engine using Steam and Air," these wor appear "One cubic foot of steam at 50 lbs. pressure expanding to 10 cubic feet drops from 280 degrees down to 165 degrees below zero. If the two (steam and air) were mixed at the same pressure and temperature it must follow that the air could not grow so exceedingly cold, but must receive a large amount of heat from the steam." Now I think that is very difficult to understand, because steam at 50 lbs pressure (above atmosphere) would have a temperature of 297 deg. F., and one cubic foot expanded to ten cubic feet would have a temperature of 170 deg. F., above zero. But assuming that "absolute" pressure is meant, then steam at 50 lbs. pressure absolute would have a temperature of 281 deg. F., and one cubic foot expanded to ten cubic feet would have a temperature of 160 deg. F. above zero. (I think the writer himself was rather mixed and the article is more unique than the engine.)

With reference to the article on "The Cold Water Delusion," I would say that the "delusion" is still very general, both here and in England, and is based on the theory that when water is poured or pumped, onto red hot iron a large volume of steam is instantly evolved ; this theory is amply substantiated in the well known form of "flash" boiler, so extensively used in England for small powers such as steam automobiles, launches, etc., the working of the "flash" boiler depends upon keeping a plate or portion of hydraulic tube at a red heat, the small amount of water required for steam is sprayed on to the red hot surface and instantly "flashes" into steam, no water at all being in the boiler, only dry steam, which may be at from 300 to 500 lbs. pressure.

Will some reader kindly furnish us with a simple and complete formulae to find the radiating surfaces required for heating dwellings, workshops, etc., by steam and hot water.

GEO. BURNISTON.

## TRADE NOTES.

Peacock Bros., Montreal, have moved from their old offices in the Canada Life building to new quarters at 68 Beaver Hall Hill. Francis Peacock sailed for Canada on September 27.

Darling Bros., Montreal, are building a three-storey extension to their plant. This building, at the corner of Prince and Ottawa Streets will be used for the general office and warehouse.

The Water and Light Commission, Barrie, Ont., awarded to the Crossley Bros., Manchester, England, at $4,332, f.o.b., Liverpool, the contract for a gas-producing plant for the water and light station.

G. H. Powell, formerly with Geo. W. Lord Co., Philadelphia, manufacturers of boiler compound, has accepted a position with the Hygienic Laboratories, 11 Colborne St., manufacturers of the Red Star boiler compound.

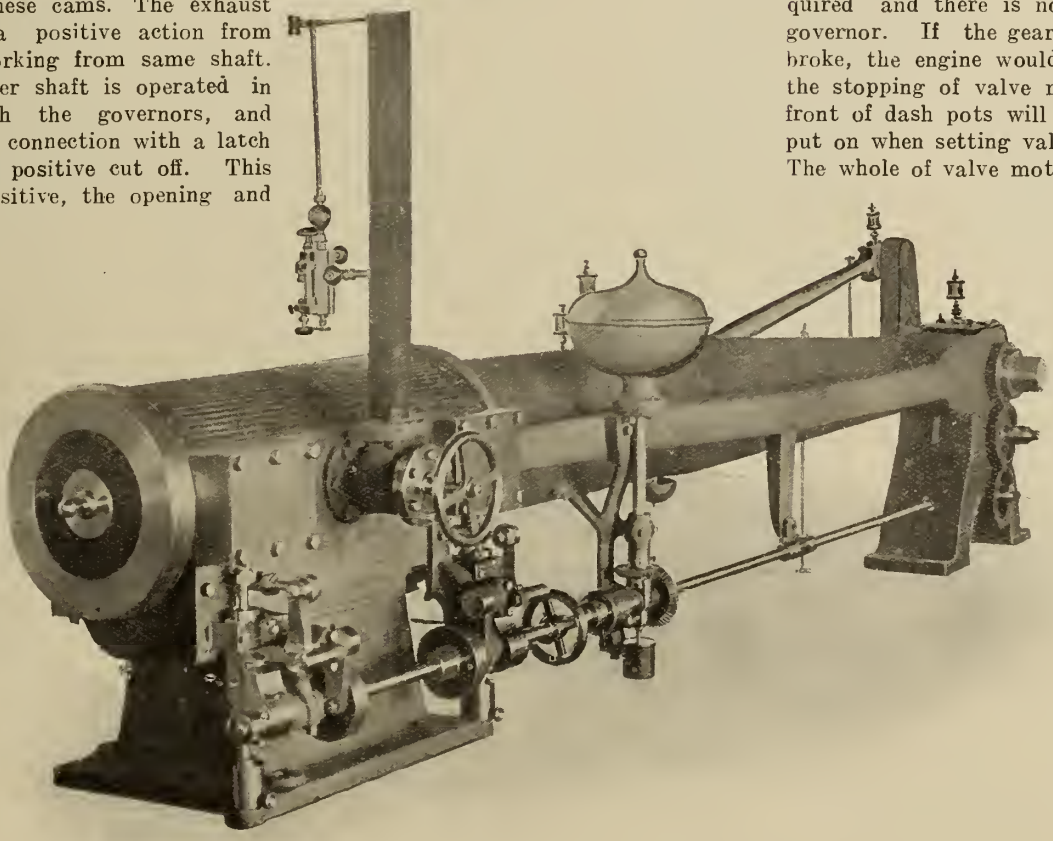
The Sterling Electric Supply Co., have opened up offices at 369 Yonge Street, Toronto, and will supply electrical contractors and central stations. Complete electrical lines will be carried, including the "Just" Tungsten lamp.

The contract for 60 transformers and switchboards in sizes of 160 k.v.a., and less for the Cobalt Power Co., has been awarded to the General Electric Mfg. Co., of Sweeden, through their representatives, Messrs. Kilmer, Pullen & Burnham, McKinnon Bldg., Toronto.

# Setting the Valves of the Brown Automatic Engine*

Fifth Article of Series on Setting Valves of Canadian Engines—The Brown Engine, Manufactured by the Stratford Mill Building Co., Stratford, Ont.

The Stratford Mill Building Co., Stratford, build the Brown Engine, which is simple in design. The steam slide valves are vertical and the "grid-iron" type exhaust valves are horizontal. These valves and also governors are operated from a shaft driven by gears from the flywheel shaft insuring positive action through the aid of cams and levers. There are two cams and rollers on this shaft. The steam valves are operated by levers working in connection with these cams. The exhaust valves have a positive action from cam levers working from same shaft. A second smaller shaft is operated in connection with the governors, and works a trip in connection with a latch hook, insuring positive cut off. This action being positive, the opening and closing of valves and the small amount of lead and lap, are great factors in securing the highest possible efficiency. The proportion of steam and exhaust ports and the valve motion is well designed so that the minimum of travel is necessary to secure the positive opening and closing of the valves. The governor is very sensitive and only slight variation of speed occurs from full load to no load.



The Brown Automatic Engine, Showing Valve Motion.

### Valve Setting.

When building these engines the various parts are made to templates and gauges, so that when being erected in the shops there is practically no skill required in putting the valves and stems in proper position. Some gauges are sent out with the engines, corresponding with those lines scratched on the stems, etc., to get absolute accuracy in setting valves. This should be done by running test and then by use of a steam engine indicator, when the slightest variation is shown by the card obtained.

The valves on the Brown engine can be set for factory purposes by the following means: Move the engine forward to "dead centre." Then move the eccentric around the shaft in same direction until the steam valve is 1-32 inch open, and the lifting guide 7-32 inch. This means that when the engine is on "dead centre" the steam valve is 1-32 inch open. By working the engine a complete revolution and trying both ends it is proved whether or not valve motion is properly proportioned.

For exhaust valve, continue to move the engine around in the same direction to within 2 inches of end of stroke from which start is made. Then loosen the cam on that end until it draws the exhaust steam out to the end of the first line marked on same (as said before, a gauge is sent out to correspond with the marks scratched on stems before leaving shops), or taking the engine forward to "dead centre" the exhaust valve should be entirely closed. Peep holes are provided in covers by which, at all times may be readily be seen the valves, which make the setting very simple when in the field.

### Governors.

The governors are positively driven by gears from the main shaft, same as valve motion (which can be seen as illustrated.) In this it is seen that the engine is under control, no belts being used. No intricate mechanism is required and there is no racing of the governor. If the gears on main shaft broke, the engine would stop owing to the stopping of valve motion. On the front of dash pots will be found marks put on when setting valve in the shops. The whole of valve motion can be moved by hand wheel on shaft when the governor is about 3-16 inch from bottom. The latch hook should be entirely free and not take hold. Then by raising governor to within ¼-inch of top, the latch hook should trip off. When moving this around, note whether the dash post corresponds to marks on valves. Adjustments can be made by plug in bottom of dash pot so as to give proper air cushion.

---

The Robb Engineering Co., Amherst, N.S., have removed their Montreal office to 607 Canadian Express building, McGill Street. It will be in charge of R. W. Robb.

* First article of series appeared in April 1909, second in May, third in July and fourth in October.

# POWER PLANT DEVELOPMENTS

News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

## Electricity and Steam.

T. Aird Murray, consulting sanitary engineer, Toronto, has been engaged by Bowmanville to prepare plans for a water supply.

Russel & Gifford, Montreal and Toronto, have secured an order for a complete Bundy trap instalation for the Victoria Hospital, London.

The Westminster Marine Railway Company's tender of $20,000 has been accepted by the Columbia Coast Mission for a boat with a 100 h.p. gasoline engine.

Vickers, Maxim & Co. and other British shipbuilding firms offer to establish navy yards in Canada if given the contract to construct the ships of the new Canadian navy.

The Hydro-Electric Commission has awarded the contracts for electric cranes and hand cranes to Royce & Co., Ancaster, Eng., and the Mussen Co., Walkerville, respectively.

Tenders will be received up to Wednesday, December 1st, on 1,000 h.p. water tube boilers, 200 lbs. pressure for the Saraguay Electric and Water Co., by Chas. Brandeis, C.E., Montreal.

The Nipissing Power Co. offers to pump the water for North Bay on a ten-year contract, at two cents per 1,000 gallons, or two cents for stated amount, and 1¾ cents for additional 1,000.

Controllers Ward and Harrison, Toronto, favor recommending to Council the letting of the contract for the motors in connection with the civic electrical pumps to the Canadian Westinghouse Co., Hamilton, at $107,000.

Tenders are invited by Port Colborne municipality for a pump with a capacity of 400 gals. per minute, in connection with waterworks extensions that are being made. Tenders for a 30 h.p. electric motor are also wanted.

The Ontario Railway and Municipal Board has approved a by-law of the Township of Coleman to raise $75,000 to provide waterworks for the town of Cobalt. The town's by-law to raise $25,000 for the same purpose has also been approved.

The contract for the Winnipeg West End exchange to be erected here by the Manitoba Government Telephone Commission has been let to J. J. & J. M. Kelly, of that city, at $43,000. The switchboard will be installed by the Northern Electric & Mfg. Co.

The order for four 750 k.v.a., water-cooled step-down transformers for the Calgary Power & Transmission Company has been awarded to the General Electric Mfg. Co., of Sweden, through their representatives in Canada, Kilmer, Pullen & Burnham, Toronto.

The contract for about 8,000 lbs., of wire for the balance of this year's electric light work was let to the Canadian General Electric Co., who have just opened a branch in Calgary, at $17.20 a hundred, with a discount allowance of the half of 1 per cent. for 30 days' cash.

The contract for 1-650 kilowatt, 120 r.p.m. engine type alternator, together with switchboard, steam driven exciter and motor generator set, for Toronto, has been awarded to the General Electric Mfg. Co., of Sweden, through their representatives, Kilmer, Pullen & Burnham, Toronto.

Chas. S. Ferry, formerly chief engineer Windsor Hotel, Montreal, and Sam. McCrudden, of the Peck Rolling Mills, have formed a partnership under the name of Ferry & McCrudden Co., 264 St. James St., Montreal. They have been appointed eastern agents for the Standard Engineering Co., Toronto, and will handle Standard Crown valves, Cyclone grates, etc.

The Board of Control, Toronto, recently awarded contracts, as follows :—Canada Foundry Co., check valves, $148.54 ; Matthew Warnock, 16-inch stop valves, $1,496 ; Jenks-Dresser Co., Sarnia, steel gates and railing for Broadview Avenue lavatory ; excavation, drainage, masonry, William Forbes & Sons, $5,590 ; joiner work, painting and glazing, William Forbes & Sons, $540 ; plumbing, heating and ventilation, John Ritchie Co., $3,700.

Harvey Motors, Ltd., is the title of a new company that is about to establish a plant in Dundas. Property bordering on the canal near the Hydro-Electric power buildings has been secured. It is the intention of the company to manufacture both marine and stationary engines. The principal promoter of the company is H. Brewer, M.E., Engineer, Geneva, N. Y., a graduate of Cornell University, who has had fifteen years' practical experience in engine designing and building, and who has some new ideas to introduce that have never before been employed in this class of engine.

Tenders will be received until Thursday, November 25th, for the packing of material and supplies for points along the Yukon Telegraph line between Quesnelle and Atlin, in the course of the season of 1910, 1911, and 1912. Forms of tender and specification may be obtained and form of contract seen on application to J. T. Phelan, Superintendent of Government Telegraphs, Vancouver, B.C. ; William Henderson, District Superintendent Government Telegraphs, Victoria, B.C. ; and from the Government Telegraph Agents at Asheroft, B.C. ; Quesnelle, B.C. ; Hazelton, B.C. ; and Telegraph Creek, B.C. Napoleon Tessier, secretary, Department of Public Works, Ottawa.

By a large vote Port Arthur ratepayers chose to accept the agreement made with the Ontario Hydro-Electric Commission for the delivery of power, in preference to the proposition from the Ontario & Nepigon Power Co. As a result of the vote Hon. Adam Beck, Chairman of the Hydro-Electric Commission, will forthwith let the contracts for the erection of the transformer station and its equipment at the estimated cost of $60,000. Hon. Mr. Beck has been successful in concluding a contract with the Kaministiquia Power Co. on a similar principle to that with the Ontario Power Co. in the Niagara district, under which power will be supplied at $17 per horsepower of only 1,000 horsepower and ultimately at $14. In the event of Port Arthur taking the power, the sister city of Fort William will also benefit to the extent of some $30,000 per year, that city having a contract which provides that in the event of reduced rates being secured by other consumers the civic price shall be similarly dropped.
Elec. and Steam.

## Victoria's Waterworks Problems.

Arthur L. Adams, Victoria's water expert, and Mr. Asheroft, assistant engineer, recently reported on the cost of bringing water from Sooke Lake. Two schemes were submitted—to bring water by a tunnel and to build a pipe line. The estimated cost of the tunnel route, as given in Mr. Adams' report, is $1,098,900, and the alternative route, is $1,064,000. It would take four or five years to install the plant and build the tunnel, which would be designed to carry 7½ million gallons daily. The cost of acquiring the lands and right of way would be $100,000. Mr. Asheroft thinks that estimate too low. His estimate of the cost of a tunnel route is $2,236,500, and the alternative route $1,663,000. These figures include $150,000 for the lands.

## New Welland Canal.

A tentative route for the new Welland canal, enlarged so that successful competition with the Erie barge canal can be had, has been agreed upon by the Canadian government engineers. The new canal will run from Port Colborne to Fifteen Mile creek, connecting with Lake Ontario there, instead of at Port Dalhousie. This canal will have 7 locks, instead of the 25 which now make the canal expensive and slow. The new canal may be built in 5 years. It will be 7 miles shorter than the present route.

## Power Rates.

Calgary has been offered power by Smith, Kerry & Chace, of the Calgary Transmission Co. at the following rates :—

| Power Required | 24-hr. Serv. Per h.p. ann. |
|---|---|
| 500 h.p. or over | $30.00 |
| 400 to 500 h.p. | 31.00 |
| 300 to 400 h.p. | 32.00 |
| 200 to 300 h.p. | 33.00 |
| 100 to 200 h.p. | 34.00 |
| 50 to 100 h.p. | 36.00 |
| 40 to 50 h.p. | 38.00 |
| 30 to 40 h.p. | 40.00 |

For 12 hours' service, 7 a.m. to 7 p.m., 10 per cent. discount.

For 11 hours' service, 7 a.m. to 6 p.m., 15 per cent. discount.

For 10 hours' service, 7 a.m. to 5 p.m., 20 per cent. discount.

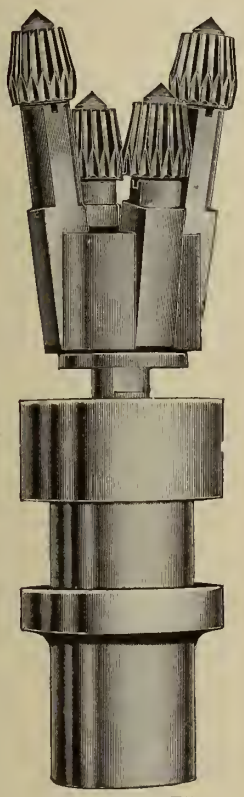
For 9 hours' service, 7 a.m. to 4 p.m., 25 per cent. discount.

## Duckworth-Boyer Co.

The Duckworth Boyer Engineering and Inspection Co., Montreal, have taken over the business of Walter R. Duckworth, C.E., Inspecting Engineer. Mr. Duckworth, who is president and manager, is a graduate of McGill and an Associate Member of the Canadian Society of Civil Engineers. He was for twelve years chief inspector for the Dominion Bridge Co. Aurelien Boyer, a graduate, of L'Ecole Polytechnique and an Associate Member of the Canadian Society of Civil Engineers, is vice-president. Mr. Boyer some years ago left the civil service in Ottawa to extend his field of knowledge and acquire more experience. Before joining this company he was acting as Chemical Engineer and Superintendent of the works of Montreal industries. The company will give special attention to the inspection of bridges and structural work, tests of materials of construction, and reinforced concrete work, also expert examination and reports.

# "LIBERTY"

## POWER PLANT EXPENSE REDUCERS



"CYCLONE" CLEANER

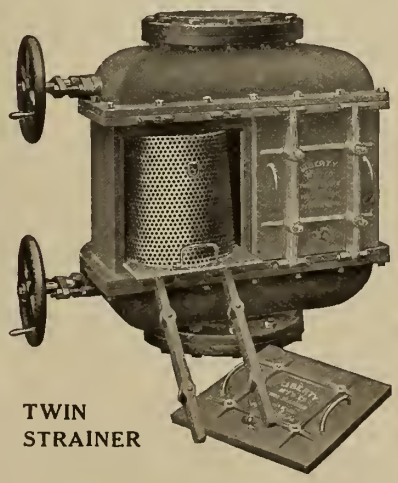
## The "Cyclone" Tube Cleaner

Can you afford to use the old-fashioned type of Turbine Cleaner? Listen to this! In one of the largest boiler rooms of the U.S.A., 3 Cyclone Cleaners are doing the work of 12 Turbine Cleaners previously used! And the "Cyclone" can save you just as much. It is very simple and compact and has a balanced blade which practically eliminates friction. Find what it costs you now to clean your tubes, then investigate the merits of the "Cyclone" and see how much it will save you.

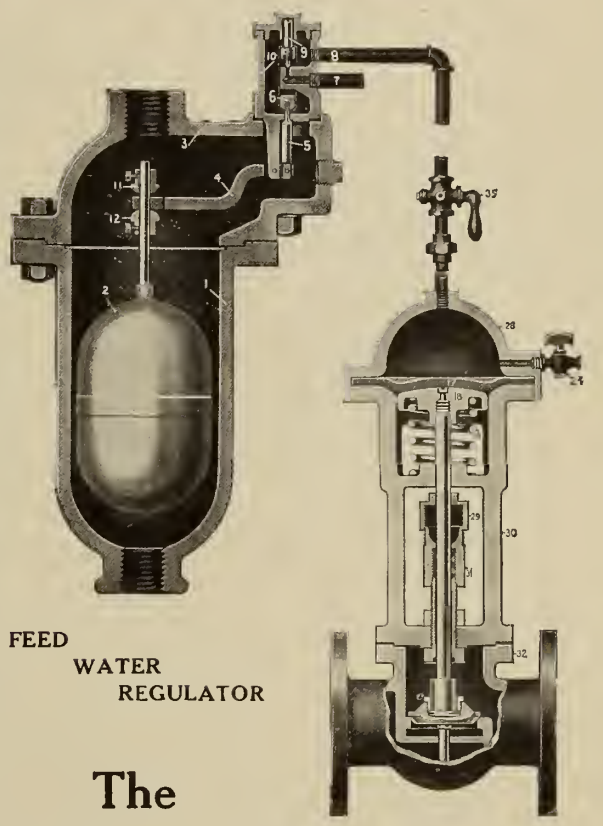
Send for catalog of FABER BLOW-OFF VALVES, OIL PURIFIERS, SEPARATORS and TURBINE CLEANERS of all types.

## The Twin Strainer

removes all solid matter from water or other liquids, and prevents expensive shut-downs. A clean basket made instantly available by shifting the valves. Indispensable for condenser installations, enabling a high uninterrupted vacuum to be maintained.



TWIN STRAINER



FEED WATER REGULATOR

## The "Liberty" Feed-water Regulator

is absolutely reliable, and there is no other apparatus in existence that can compare with it in reliability, durability and workmanship for controlling the water level in boilers. Its principal features are: Few parts, accessibility, adjustment under steam, capability of operating under any steam pressure.

WRITE FOR FULL DETAILS

## The Liberty Manufacturing Co.

6902 Susquehanna Street, : : PITTSBURG, U.S.A.

# Power Supply Markets

## TORONTO.

Business in steam specialties, including traps and all boiler accessories continues good and general trade conditions in all power lines are ahead of last year.

BOILERS—J. J. Main, general manager of Polson Iron Works, says the boiler business this year has aggregated as much as the two previous years. This seems to be the consensus of opinion among boiler dealers. As it was expressed to the editor The Power House, "the boiler business was never better." The same applies to grates, showing that manufacturers are giving more attention to their power plants and cost of power.

BOILER TUBES—Lap welded steel per 100 ft., 2-in., $8.50 to $8.75; 2¼-inch, $10 to $10.75; 2½-inch, $10.75; 3-inch, $12; 3½-inch, $15, and 4-inch, $18.50 to $19.

COAL—Retail price for Pennsylvania hard, $6.75 net. This price applies to grate, egg, stove, and chestnut; pea coal is namely $5.75. These are cash.

INCANDESCENT LAMPS—There is a big sale of these and the many types on the market are finding a ready market. An order-in-council from Ottawa has been made transferring to the free list the following:—Metallic elements, and tungstic acid when imported by manufacturers for use is their own factories in manufacture of metallic filaments for electric lamps.

BELTING—The belting dealers report sales continuing upon the high level. An Ottawa order-in-council adds to the free list the following material for Canadian manufacturers:—Hyposulphite of soda when imported for use in their own factories for the tanning of leather.

MECHANICAL RUBBER GOODS—Since crude rubber of the grade known as "Fine up-River Para," reached the record price of $2.15 per pound, around the first of October, there has been a gradual easing of the price, which has since dropped to $1.81. An officer of the General Rubber Co., one of the largest buyers of the product, said that the rapid rise in prices over the past two years is to be attributed chiefly to the increasing consumption of the material in automobile tires.

How great this factor in the trade has become may be seen from the fact that the prices have gone steadily upward in the face of a largely-augmented supply and in spite of the business depression of the after-panic days. The New York market has been somewhat handicapped in keeping in touch with the situation in Brazil by the breaking of the Manaos cable at Para, which has been out of commission since September 17, and in consequence of which advices are late in reaching the centres of distribution.

The increase in the supply is illustrated by the figures of receipts at Para, which for twenty-two days in October, were 2,250 tons, against 2,116 tons for the same period in 1908. At Manaos for the full month, receipts were 2,760 tons, against 2,355 in October, 1905. Corresponding increases have been made in the production of Malay rubber, which in the first seven months of 1909 exceeded that of the same period in 1908 by 1,390,168 pounds. October's prices of crude rubber compare with $1.10, the high for October, 1908, and $1.02, the low. In 1907 the range for October was $1.06 to 98 cents, and in 1906, $1.22 to $1.24.

LEAD WOOL—Price $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35; American, $25 to $35 per 1,000.

## CATALOGUES.

INDICATORS—The Trill Indicator Co., Corry, Pa., has issued an attractive 42-page booklet describing its various types of indicators, faultless reducing motion, Trill planimeter, and indicators for high-pressure and ammonia work. Besides the description of the apparatus, interesting discussions are given on numerous cards and the causes of various unusual curves pointed out. A method is also given for drawing adiabatic and saturation curves. There is also a chapter on indicating gas engines with discussions of faulty diagrams and a chapter on indicating compound engines and drawing combined cards. This book may be had by writing the company for a copy.

VALVES—The Standard Engineering Co., Toronto, have issued a neat folder on the Standard Crown Valves describing in detail both globe and check valves. These are made both screwed and flanged.

BLUE PRINT PAPER—Keuffel & Esser Company, Hoboken, N. J., Circular1 Trents of the Helios blue print papers, which are put up in different qualities for special purposes, including regular blue print paper requiring from four to eight minutes' exposure for bright sunlight, paper intended for quick reproductions where no good light is available, and paper for use with electric light and with electric printing machines. The circular also calls attention to the fact that the company does blue printing for the trade. The Canadian brand is 252 Notre Dame St., Montreal.

GENERATORS—Conditions frequently arise in the design of alternating current power stations, under which it is impracticable to have the prime mover mounted on the same shaft with the generator. In order to meet these conditions the large sizes of coupled type generators have been developed. Machines of this class are described in Bulletin No. 114 recently issued by the Crocker-Wheeler Company, Ampere, N. J.

ENGINES—The problem of balancing high speed steam engines is discussed in a clear manner in a pamphlet that is being distributed by the American Engine Company, Bound Brook, N. J. The author shows how an engine can be balanced if two cylinders be suitably arranged and gives a brief description of the American Ball Angle Compound Engine. It is pointed out that the balance obtained makes it feasible to instal this engine upon upper floors and in other places where vibration would be objectionable, also that the even turning moment incidentally secured makes it possible to use lighter fly wheels and results in less pressure upon bearing surfaces besides giving more satisfactory operation of alternating current generators. Copies of the pamphlet will be sent gratis to engineers interested in the subject.

STEAM TRAP—A folder from Richard J. Flinn, West Roxbury, Mass., describes the Flinn steam trap, gives the operation with sectional illustration, and describes applications of the dufferential traps.

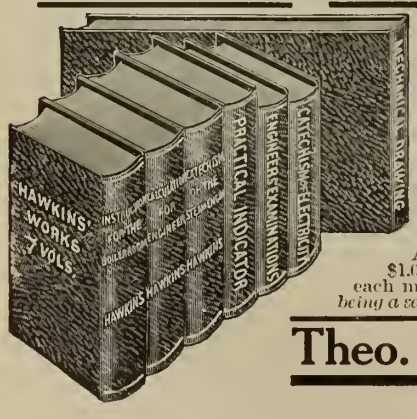
STEAM ENGINE INDICATOR—The Trill Indicator Co., of Corry, Pa., has just issued an attractive 44-page booklet describing their various types of indicators. This book also describes the faultless reducing motion, trill planimeter, and indicators for high pressure and ammonia work. Besides the description of the apparatus, interesting discussions are given on numerous cards and the causes of various unusual curves pointed out. A method is also given for drawing adiabatic and saturation curves. There is also a chapter on indicating gas engines with discussions of faulty diagrams and a chapter on indicating compound engines and drawing combined cards.

CONVEYING MACHINERY—Booklet 29, from Jeffrey Mfg. Co., Cote and Lagauchetiere Sts., Montreal, describes and illustrates fully methods for handling freight and packages. A post card will bring a copy.

THREADING TOOLS—The American Tap & Die Co., Greenfield, Mass., have issued their 1909 catalogue, No. 3, of "Adamatine Threading Tools. The line of taps, dies, screw plates, hobs, reamers, etc., is complete, full information being given in regard to taps and dies, such as sizes made, length, number of threads and price. The cover design adopted is effective in setting forth the trade mark and products listed in the catalogue.

SWITCHES—Bulletins 1, 2, 3 and 4—A—describing and illustrating style "D" switches; "BB" switches and parts for switchboard work; "B" switches; and panel boards respectively from the Hill Switch & Mfg. Co., 1560 St. Lawrence Boulevard, Montreal. These are all specialties of this company and full information with prices, is given. The bulletins are neatly bound in a cardboard cover which may be used for filing future bulletins as they are issued.


# HAWKINS' ENGINEERS LIBRARY.




Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,208 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

SPECIAL OFFER Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month *(when complete set is purchased the price is $12, being a saving of One Dollar)*. Hawkins' Circular free on request.

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

THEO. AUDEL & CO., 63 Fifth Ave., New York

Please send me the books marked (X). I enclose $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

(X) HERE

| | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | $2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed. ..... (Firm Name)

Home Address .....

## BOOK REVIEWS.

NATURAL SOURCES OF POWER—By Robert S. Ball, B.Sc. Published by the D. Van Nostrand Co., 23 Murray St., New York. 348 pages, 5 x 8 ins., illustrated. Price $2 net.

The book is divided into eleven chapters dealing with water and wind power. Waterpower being the more important occupies the first and greater part of the volume. The use of these two forms of power is increasing, the useful application of them having broadened out. The book is of service to consulting engineers and designers. An idea of the contents may be obtained by a reference to the chapters: 1, Introduction; 2, Water Power and Methods of Measuring; 3, Application of Water Power to the Propulsion of Machinery; 4, the Hydraulic Turbine; 5, Various Types of Turbine; 6, Construction of Water-Power Plants: 7, Water Power Instalations; 8, the Regulation of Turbines; 9, Wind Pressure, Velocity, and Methods of Measuring; 10, the Application of Wind Power to Industry; 11, Modern Windmills, Construction Details, and 12, Power of Modern Windmills.

INTERNAL COMBUSTION ENGINES—By Wm. M. Hogle, B.S. Published by McGraw-Hill Book Co., New York. 256 pages, 5½ x 8½ ins., illustrated. Price $3 net.

This book of reference for designers, operators, engineers and students is compiled by Wm. M. Hogle, Consulting Engineer, Toledo, Ohio. It is a compact reference book treating fully the subject of gas engines. The book is thoroughly up-to-date dealing with modern practice and gas engine design. The more involved mathematical formulae are eliminated as far as practicable, the subject matter being confined to the more practical and applied phase. In the matter of design average practice has been considered and results obtained from the formulae given will insure results closely in keeping with average modern practice.

The chapters deal with the Rochos and Clerk cycles and the Diesel motor. The different cycles are compared and troubles and their remedies are discussed. All the accessories and parts are described, carburettors, vaporisers, injectors, governing mechanism and their design. Other subjects are producers, fuels, engine foundations, engine cards, engine testing, etc.

---

## WORTH THE DOLLAR.

Editor The Power House.

Your books to hand June and July numbers, which I may state are about as good a dollar's worth a man could invest in, especially the June number that is good. I am enclosing you my subscription $1, and also $1 subscription for Mr. Sharrocks. You may hold this subscription for me as I have a few more to send you later, then I will decide what premium to take.

W. H. HILTON.

## WANTED.

MEN selling on commission, or men whose time is not fully employed, should become our agents. The Canadian Grocer, Dry Goods Review, Hardware and Metal, Printer and Publisher, Bookseller and Stationer, Plumber and Steamfitter, Canadian Machinery and Power House are all well known and highly regarded trade papers, with a large circulation throughout Canada, United States and Great Britain. The circulation must be maintained and increased. We pay large commissions to men who push for new subscribers. If you can do anything in this way write the Circulation Department, giving references. The MacLean Publishing Co., Toronto.


**ELECTRIC BARGAINS**

**We have some GOOD, PRACTICALLY NEW, MOTORS GOING AT A SACRIFICE**

We manufacture alternating and direct current motors in all sizes also sell Century single phase motors in all their sizes. Repairs promptly and cheaply performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Torooto, Oot

**Chief Draftsman AND ENGINEER**

will **personally—practically** instruct a few ambitious, deserving, bright men on practical, actual, up-to-date **Drafting Room Work** at home, prepare and qualify them as first-class **experienced Draftsmen** and **Designers** for a salary **paying $100 to $150 per month.**

Instructions until competent, and **placed in position free.** Also complete high grade drawing outfit, with German Silver set of **instruments worth $13.85 free this month. Don't** answer this unless you are ambitiously seeking success and willing to work for results.

**Address CHIEF DRAFTSMAN, Div. 22**
**ENGINEERS EQUIPMENT CO. (INC.) CHICAGO, ILL.**

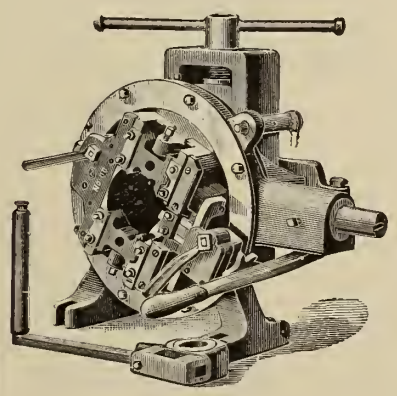

**Persons addressing advertisers will kindly mention having seen their advertisement in this paper.**


**NOTICE TO STATIONARY ENGINEERS**

Every Certificate holder who intends to renew his Certificate should register with the Board not later than the First day of December, 1909, on a form which will be supplied. Any one who has not registered by the First of February, 1910, will not be granted a renewal only on the payment of the fee of Five Dollars.

I would also request those who have changed their address since receiving their certificate for 1909, and have not notified the Board, to do so at once.

W. C. McGHIE,
Chairman,
Parliament Buildings, Toronto



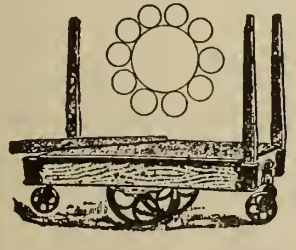
ARMSTRONG
**Pipe and Bolt Threading Machine**

Both Hand and Power
Made to use the
**Genuine Armstrong Dies**

Cuts Pipe from 1 to 4 in.
Cuts Bolts " ½ to 2 in.

**BUILT FOR SERVICE**
**ALL PARTS INTERCHANGEABLE**
Write for Catalogue to

**The Armstrong Mfg. Co.**
299 Knowlton St., Bridgeport, Conn
New York Chicago



**Roller Bearing Factory Trucks**

The only ones made in Canada

**Dry Kilns Installed**

Roller Bearing Dry Kiln Trucks
Roller Bearing Transfer Trucks
Roller Bearing Lumber Trucks

**MUNICIPAL STEEL BRIDGES** Specifications Solicited.

We make any kind of truck to specifications. Heavy duty truck a specialty. Write for prices to

**Corbet Foundry & Machine Co.,** Owen Sound

**Switch Board Parts**

**Bulletin 3A—Just Out.**

SEND FOR COPY.

**The Hill Electric Switch & Mfg. Co., Ltd,**

1560 St. Lawrence Street - Montreal

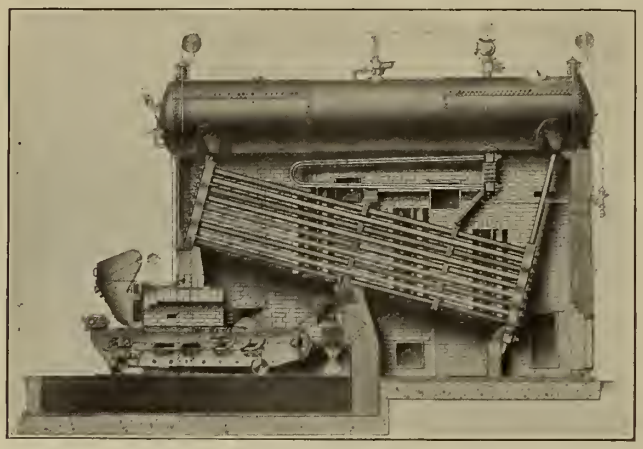

The advertiser would like to know where you saw his advertisement—tell him.

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

**With Furnaces for all Classes of Fuel or Waste Gases**

**HIGHEST ECONOMY, SAFETY, DURABILITY** **OVER 7,000,000 H.P. IN USE**



Babcock & Wilcox Patent Water Tube Boiler, Superheater, and Mechanical Stoker

ALSO

**Steam Superheaters**
**Mechanical Stokers**
**Coal-Handling Machinery**
**Piping, Feed Water Heaters**
**Water Softeners and Purifiers**
**and ELECTRIC RANGES**

Our Book "STEAM" sent on request

**HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL**

**TORONTO OFFICE, TRADERS BANK BUILDING**

# STEAM EQUIPMENT

### Horizontal Boilers

1 refitted 60"x17'6" with 54—4" tubes.
1 new 60"x16' with 44—4" tubes.
1 refitted 60"x13'8" with 78—3" tubes.
1 refitted 60"x13'6" with 72—3" tubes.
1 refitted 54"x14' with 70—3" tubes.
1 refitted 60"x12' with 70—3" tubes.
1 refitted 50"x14' with 64—3" tubes.
1 refitted 50"x14' with 60—3" tubes.
1 refitted 56"x12' with 60—3" tubes.
1 refitted 48"x15' with 54—3" tubes.
1 refitted 48"x13'6" with 44—3" tubes.
1 refitted 52"x11' with 68—3" tubes.
1 refitted 48"x15'6" with 52—3" tubes.
1 refitted 48"x13'6" with 42—3" tubes.
1 refitted 48"x12' with 52—3" tubes.
1 refitted 44"x13'2" with 48—3" tubes.
1 refitted 44"x11'9" with 42—3" tubes.
1 refitted 40"x12' with 32—3" tubes.
1 refitted 40"x13'4" with 36—3" tubes.
1 refitted 38"x15' with 34—3" tubes.
1 refitted 38"x12' with 26—3" tubes.
1 refitted 40"x11'5" with 40—3" tubes.
1 refitted 38"x13'2" with 33—3" tubes.
1 refitted 38"x10'11" with 28—3" tubes
1 refitted 32"x11' with 23—3" tubes.
1 refitted 34"x7'2" with 40—2" tubes.
1 refitted 43"x49" with 60—2½" tubes.
1 refitted 15"x30" with 4—3" and 9—2" tubes.
1 refitted 15½"x27" with 21—2" tubes.

### Fire Box Boilers

1 refitted 48"x20' with 52—3" tubes.
1 refitted 44"x18' with 46—3" tubes.
1 refitted 36"x13'10" with 36—3" tubes
2 new 36"x13'3" with 58—2" tubes.
1 refitted 36"x13' with 44—2½" tubes.
1 refitted 36"x12'10" with 43—2½" tubes
1 new 30"x11'7" with 42—2" tubes.

### Vertical Boilers

1 refitted 48"x10'6" with 152—2" tubes
1 new 42"x87" with 92—2" tubes.
1 new 36"x96" with 68—2" tubes.
2 new 36"x96" with 55—2" tubes.
2 new 36"x78" with 68—2" tubes.
1 refitted 36"x87" with 78—2" tubes.
1 new 36"x84" with 55—2" tubes.
1 refitted 40"x65" with 137—1½" tubes.
1 new 36"x72" with 55—2" tubes.
1 refitted 30"x62" with 56—2" tubes.
2 refitted 30"x60" with 43—2" tubes.
1 new 26"x60" with 37—2" tubes.
1 new 24"x60" with 31—2" tubes.
1 refitted 26"x48" with 37—2" tubes.
1 new 24"x50" with 31—2" tubes.
1 refitted 25"x43" with 61—1½" tubes.
1 refitted 20"x36" with 16—2" tubes.
1 refitted 19" x37" with 14—2" tubes.
35 new 19"x44" with 13—2" tubes.
2 refitted 19"x44" with 13—2" tubes.

### Automatic Engines

2 refitted 12"x12" Robb Armstrong.
1 refitted 9"&16"x12" Ball tandem.
1 refitted 12"x30" Corliss.
1 refitted 12"x28" Corliss.
1 refitted 12"x10" Westinghouse Jr.
1 new 10"x15" Jewel.
1 refitted 9½"&14½"x12" tandem.
1 refitted 8"&13"x18" tandem.
1 refitted 10"x28" Wheelock.
1 refitted 10"x24" Corliss.
1 refitted 10"x24" Brown.
1 refitted 9"x24" Wheelock.
1 refitted 10"x20" Brown.
1 refitted 8"x24" Wheelock.
1 refitted 8"x24" Brown.
1 refitted 6½" x 9" Armington & Sims
1 new 6"x7" vertical.

### Vertical Engines

1 refitted 16"x16" slide valve.
1 new 7½"x10" Dutton slide valve.
1 new 7½"x9" Dutton slide valve.
1 new 7½"x8" Dutton slide valve.
2 refitted 6½"x8" Doty slide valve.
2 new 6"x7½" Dutton slide valve.
1 new 5"x5" American high speed.
1 new 4½"x5" Dutton slide valve.
1 new 4"x5" Dutton slide valve.
1 refitted 3½"x5" slide valve.
1 refitted 3"x3" slide valve.

### Horizontal Engines

1 refitted 16"x24" rocking valve.
1 refitted 11¼"x14" slide valve.
1 new 12"x15" slide valve.
1 nearly new 12"x12" slide valve.
1 new 11"x15" slide valve.
1 refitted 10½"x16" slide valve.
1 nearly new 10"x15" slide valve.
1 new 10"x12" slide valve.
1 refitted 8½"x9" slide valve.
2 refitted 8"x10" slide valve.
1 refitted 8"x13" slide valve.
1 refitted 8"x12" rocking valve.
1 refitted 7"x10" slide valve.
1 refitted 8"x8" slide valve.
1 refitted 7½"x12" slide valve.
1 refitted 7"x12" rocking valve.
2 refitted 5"x6" slide valve.
1 refitted 3¼"x5" slide valve.
1 refitted 2½"x5" slide valve.
1 refitted 2½"x3" slide valve.

### Marine Engines

1 new 12"&23"x18" steeple compound
2 new 7"&14"x10" F.& A. compound.
1 refitted 16"x16" slide valve
1 new 9"x12" slide valve.
1 new 6"x7½" slide valve.
1 refitted 6"x6" slide valve.
1 refitted 4"x4" double cylinder.
1 new 3½"x5" slide valve.

***OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST***

# H. W. PETRIE, Ltd., Toronto, Montreal, Vancouver

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co , Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

R. H. Buchbnan & Co., Montreal
Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

R. H. Buchanan & Co., Montreal
Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. D. McArthur, Brockville
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

W. H. Adams, 102 Nazareth St., Montreal, Que.
Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Electric Boiler Compound Co., Guelph, Ont.
Hygienic Laboratories, Toronto
Nichols Chemical Co., Montreal
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto
Michigan Lubricator Co., Detroit
Morehead Mfg. Co., Detroit, Mich.

## Boiler Feed Pumps.

R. H. Buchanan & Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Michigan Lubricator Co., Detroit
Wm. B. Pierce Co., Buffalo

## Boilers.

Babcock & Wilcox, Montreal
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Standard Engineering Co., Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Boosters.

Geo. C. Royce, West Toronto

## Canners' Machinery.

J. C. Wilsou & Co., Glenora, Ont.

## Cars, Transfer.

Corbet Foundry and Machine Co., Owen Sound

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Canada Chemical Mfg. Co., London

## Circuit-Breakers.

Geo. C. Royce, West Toronto

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Coal Handling Machinery

Standard Engineering Co., Toronto

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beaubien, Montreal.
Death & Watson, Toronto.
John T. Farmer, Montreal
Walter J. Francis, Montreal.
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
Moore & Scollan, Toronto
John B. McRae, Ottawa
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto
Standard Engineering Co., Toronto

## Contractors, Structural Steel

Corbet Foundry and Machine Co., Owen Sound

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenora, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo, N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Mechanical & Elec. Lab., Buffalo
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto
Packard Electric Co., St. Catharines.

## Electrical Accessories.

Chapman & Walker, Toronto

## Electrical Machinery.

Chapman & Walker, Toronto

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford.

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Chapman & Walker, Toronto
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Fielding & Platt, Ltd., Glouce-ter, Eng.
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford.

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Russel & Gifford, Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Obio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N Y.

## Fire Brick.

McLeod & Henry Co., Troy, N.Y.

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

ercules Float Works, Springfield, M

## Flumes, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Fuses.

Geo. C. Royce, West Toronto

## Gas Producer Plants.

Bain & Mitchell, Montreal
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Fielding & Platt, Ltd., Gloucester, Eng.
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Gas & Electric Power Co., Torouto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peterboro Lubricator Mfg. Co., Peterboro

## Greases

Electric Boiler Compound Co., Guelph, Ont.

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brautford
J. C. Wilson & Co., Glenora, Ont.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Indicators, Electric—All Types.

Geo. C. Royce, West Toronto

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Chapman & Walker, Toronto
Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

## Lubricators, Force Feed.

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Maple Cogs.

J. C. Wilson & Co., Glenora, Ont.

## Mechanical Stokers.

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

## Meters, Water and Electric.

Peiler & MacKenzie, Montreal
Geo. C. Roper, West Toronto

## Mill Machinery.

Allis-Chalmers Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg, Co., Lindsay, Ont
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Out.

## Mining Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Motor Starters.

Geo. C. Royce, West Toronto

## Oil and Waste Saving Machines.

The Canadian Oil & Waste Saving Machnie Co., Brockville, Ont.

## Oilers, Gang.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Oil Filters

Darling Bros., Montreal

## Oil Separators.

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Russel & Gifford, Montreal
Standard Engineering Co., Toronto

## Oils, Lubricating.

Electric Boiler Compound Co., Guelph Ont.
The "Skaleoff" Co., Montreal, Que.

## Packing, Leather.

R. H. Buchanan & Co., Montreal
Detroit Leather Specialty Co., Detroit
Electric Boiler Compound Co., Guelph, Ont.

## Packing, Metallic.

Rhodes Improved MetallicPacking Co. Montreal

## Panels, Electric

Hill Electric Switch Co., Montreal

## Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

## Pipe Cutting and Threading Machines.

Curtis & Curtis Co., Bridgeport, Conn.

## Pipe Threading Tools.

Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

## Piping, Steam,

Babcock & Wilcox, Montreal

## Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

## Polish, Metal,

G. W. Hoffman, Indianapolis

## Power Pumps.

R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

## Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

## Processing Retorts.

J. C. Wilson & Co., Glenora, Ont

## Pulleys, Iron.

J. C. Wilson & Co., Glenora, Out

## Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Montreal

## Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Pump Strainers.

Canadian Steam Boiler Equipment Co., Toronto

## Pumps, Air,

Lunkenheimer Co., Cincinnati, Ohio

## Pumps, Oil.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Rheostats.

Geo. C. Royce, West Toronto

## Safes.

Goldie & McCulloch Co., Galt.

## Safety valves.

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford,
J. C. Wilson & Co., Glenora, Ont.

## Shaking and Dumping Grate

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

## Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto
The "Skaleoff" Co., Montreal, Que.

## Smoke Stacks.

Babcock & Wilcox, Montreal
Corbet Foundry and Machine Co., Owen Sound

## Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

## Sprocket Wheels.

J. C. Wilson & Co., Glenora, Ont.

## Spur Wheels.

J. C. Wilson & Co., Glenora, Ont.

## Steam Pumps.

R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Steam Separator.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Russel & Gifford, Montreal

## Steam Specialties.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Russel & Gifford, Montreal
Standard Engineering Co., Toronto.

## Steam Traps.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Morehead Mfg. Co., Detroit, Mich.
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

## Stokers.

Erie Foundry Co., Erie, Pa.

## Switches, Electric

Hill Electric Switch Co., Montreal

## Superheaters, Steam,

Babcock & Wilcox, Montreal

## Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co, Montreal
Geo. C. Royce, West Toronto

## Switches.

Geo. C. Royce, West Toronto

## Tanks, Blow-off

Darling Bros., Montreal

## Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

## Tanks, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Tests and Inspections.

Bain & Mitchell, Montreal

## Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal
Geo. C. Royce, West Toronto

## Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

## Trucks, Dry Kiln.

Corbet Foundry and Machin Co., Owen Sound, Ont.

## Trucks, Factory.

Corbet Foundry and Machine Co., Owen Sound

## Tubes, Boiler,

Babcock & Wilcox, Montreal

## Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd., Montreal
Jenckes Machine Co., Sherbrooke, Que.
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

## Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

## Unions

Dart Union Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit

## Vacuum Drying and Impregnating Apparatus.

J. P. Devine Co., Buffalo, N.Y.

## Vacuum Governors.

Canadian Steam Boiler Equip ent Co Toronto

## Vacuum Pans.

J. P. Devine Co., Buffalo, N.Y.

## Vacuum Pumps.

Canadian Steam Boiler Equipment Co, Toronto
J. P. Devine Co., Buffalo, N.Y.

## Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Vacuum Traps.

Morchead Mfg. Co., Detrolt, Mich.
Russel & Gifford, Montreal

## Valve Reseating Machines

Darling Bros., Montreal

## Valves.

Canadian Steam Boiler Equipment Co Toronto
Jenkins Bros., Montreal
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Standard Engineering Co., Toronto.

## Vaults & Vault Doors.

Goldie & McCulloch Co., Galt

## Water Purifiers.

Babcock & Wilcox, Montreal

## Water Softeners.

Babcock & Wilcox, Montreal

## Watt Meters.

Gas & Electric Power Co., Toronto

# ALPHABETICAL INDEX TO ADVERTISERS


Albany Steam Trap Co ..... 8
Allis-Chalmers-Bullock ..... inside front cover
Armstrong Mfg. Co..... 55
Audel, Theo., & Co ..... 54

Babcock & Wilcox ..... 56
Beaubien, De Gaspe ..... 61
Brownell Co ..... 3
Buchanan, R. H., & Co..... 59
Buffalo Mechanical and Elec. Lab..... 59
Butterworth Foundry Co ..... 4

Canada Gas Power & Fuel Co ..... 15
Canada Metal Co ..... 14
Canadian Assn. Stationary Engineers..... 16
Canadian Oil and Waste Saving Machine Co ..... 19
Chapman & Walker, Limited..... 64
Cling-Surface Co ..... 10
Corbet Foundry & Machine Co..... 55
Curtis & Curtis..... 59

Darling Bros ..... 17
Dart Union Co.. ..... 6
Death & Watson ..... 61
Detroit Leather Specialty Co..... 13
Devine, J. P., Co..... 62
Diamond Crate Bar Co ..... 4
Diamond Power Specialty Co..... 7
Dietrich, W. N..... 61
Dominion Electric Co ..... 64

Electrical Maintenance & Repair Co ... inside back cover
Electric Boiler Compound Co ..... 15
Engineers' Equipment Co ..... 55

Farmer, John T..... 61
Fetherstonhaugh..... 61

Francis, Walter J..... 61

Galt & Smith ..... 61
Garde, John, & Co ..... 59
Goldie & McCulloch Co ..... 20
Goodhue, J. L., & Co ..... 12
Gould, Shapley & Muir ..... 9

Hercules Float Works ..... 61
Hill Electric Switch Co ..... 55
Hoffman, G. W..... 59
Hoffman, Jules G ..... 14
Hygienic Laboratories..... 1

Ideal Steam Separator & Supply Co..... 9

Jenckes Machine Co ..... 3
Jenkins Bros..... 6
Johnson, F. M. G..... 61
Jones & Moore Electric Co ..... 55
Jones Underfeed Stoker Co ..... 16

Kerr Engine Co ..... 9
Kilmer, Pullen & Burnham ..... inside back cover

Leonard, E., & Sons ..... 3
Liberty Mfg. Co..... 53
Lunkenheimer Co ..... 6

McArthur, J. D..... 12
McGhie, W. C..... 55
McLaren, D. K., Ltd ..... 11
McLood & Henry Co ..... 17
McRae, J. B ..... 61

Merrill, Edward B ..... 61
Michigan Lubricator Co..... 13
Mitchell, C. H. & P. H. ..... 61
Moore & Scollan..... 61
Morehead Mfg. Co..... 5
Morrison Brass Mfg. Co., Ltd., Jas outside back cover

National Pipe Bending Co ..... 5
Nichols Chemical Co ..... 8
Northern Electric and Mfg. Co..... 62

Packard Electric Co., Ltd..... 63
Peiler & MacKenzie ..... 8
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 56
Pierce, Wm. B..... 17
Plomo Specialty Mfg. Co..... 12
Polson Iron Works..... 2

Riblet Heater Co ..... 7
Robb Engineering Co ..... 19
Robertson, J. M ..... 61
Russel & Gifford ..... 5
Royce, G. C ..... 63

Sadler & Haworth ..... 19
Sammett, M. A..... 61
Shanly, J. M ..... 61
Sight Feed Oil Pump Co ..... 15
Snowdon, C. C..... 14

Technical Books ..... 18
Turbo-Blower Co..... 7

Waterous Engine Works Co..... 1
Williams, Madison, Co ..... 16
Wilson, J. C., & Co..... 61

## MISCELLANEOUS.

ACCURATE COST KEEPING IS EASY If you have a Dey Cost Keeper. It automatically records actual time spent on each operation down to the decimal fraction of an hour. Several operations of jobs can be recorded on one card. For small firms we recommend this as an excellent combination—employe's time register and cost keeper. Whether you employ a few or hundreds of hands, we can supply you with a machine suited to your requirements. Write for catalog. International Time Recording Company of Canada, Limited, office and factory, 29 Alice Street, Toronto.

ANY MAN who has ever lost money in the mails has had occasion to learn by painful experience that the only proper way to remit money is by Dominion Express Money Orders and Foreign Drafts. If lost or delayed in the mails, a prompt refund is arranged, or new Order issued without further charges. (tf)

ADDING TYPEWRITERS write, add or subtract in one operation. Elliott Fisher, Limited, 129 Bay Street, Toronto.

CASH AND PACKAGE CARRIERS. 20 years experience inventing and building modern store service appliances. Our Guarantee—We will install a system of our carriers in your store; you use them ten days, and if you do not find that they give you better and quicker service than any other wire carriers, pneumatic tubes, cable carriers or cash registers, we will remove them at our expense. Write for catalog and testimonials from reliable houses using our carriers. The Gipe Carrier Co., 99 Ontario Street, Toronto, Ontario.

INSTAL an Otis-Fensom Hand-Power Elevator. Costs only $70. Merchants and other business men can turn a second-story lumber room into a properly equipped warehouse, leaving ground-floor unhampered by reserve stock, packing cases, etc. When power is available, we suggest a belt-driven elevator operated by motor or line shaft. Write for catalogue containing illustrations of the different kinds of elevators we handle. Otis Fensom Co., 1401, Traders' Bank Building, Toronto. (tf)

OFFICE FIXTURES, PARTITIONS and SHOW CASES. Send for Illustrated catalogue. Jones Bros. & Co., Limited, 30-32 Adelaide Street W., Toronto, Ont. (tf)

YOUR personal reputation and dignity should be reflected by your office appearance. Our office fittings are artistic in design, thorough in workmanship and pleasing in finish. Our illustrated catalogue contains much interest to every business man. Send for it to day. Dept. E, Dominion Office and Store Fittings Co., Ltd., London, Ont. (tf)e

PROBABLY the most talked about machine in Canada is the Hainer Book-keeping Machine. Everybody helps to sell it who has seen it, or it will sell itself when exhibited. It combines in one machine the cash and credit register, time recorder and account register. We want representatives everywhere—alert, intelligent, not afraid to hustle. Write for our proposition. Book-keeping Machines, Ltd. Head offices and show rooms, 424 Spadina Avenue, Toronto. Branches, Vancouver, Winnipeg, Montreal. (tf)

PEERLESS CARBON PAPERS and TYPEWRITER RIBBONS are unequalled in writing, manifolding and wearing qualities. Our "Kleer Kopy" Carbon was awarded a contract over 43 competing lines by one of the world's largest governments. All up-to-date dealers in stationery, typewriters and office supplies handle our goods. Ask them or write us direct for prices and samples. Peerless Carbon & Ribbon Manufacturing Co., Toronto, Canada. (tf)

"SYSTEMS" stand for all that is best in loose-leaf binders and supplies, letter-heads, statements and in fact your office stationery of every description. Send us samples of what you are using—we will send you prices that will interest you. Business Systems, Limited, Manufacturing Stationers, Toronto.

SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling and greatly facilitates the loading of cars, drays, etc., and for handling goods in and about the warehouse and factory reduces the cost of labor because far less warehouse help is required. Systems for all kinds of businesses, large or small. Write us for illustrated catalog. W. D. Beath & Son, 193 Terauley St., Toronto. (tf)

THE ability of your hand-writing, as well as the ease and speed with which you execute it, are matters of great importance. They are also matters of pen point. Use "Crucible" Steel Pens and settle the matter. 15 different styles. Ask your dealer for free samples and pick out the pen you want. If he cannot supply you, ask us and we will send samples by return mail. The Copp, Clark Co., Ltd., 64-66 Front St W., Toronto.

THE National Cash Register Company guarantee to sell a better Register for less money than any other house on earth. We can prove it. Make us. The National Casb Register Co., 285 Yonge Street, Toronto.

THE "Kalamazoo" Loose Leaf Binder is the only binder that will hold just as many sheets as you actually require and no more. The back is flexible, writing surface flat, alignment perfect. It cannot get out of order. No exposed metal parts or complicated mechanism. Write for booklet. Warwick Bros. & Rutter, Ltd, King and Spadina, Toronto.

TAYLOR-FORBES COMPANY, Limited. Boilers, Radiators. Largest makers of house heating systems under the British flag. Guelph, Canada. (tf)

YOUR CHEQUE CAN'T BE RAISED to any amount above that which you intend it to cover if you use the PROTECTOGRAPH. This device stamps a line such as "Not over ten dollars, $10," with acid proof, indelible ink, which penetrates right through the fibre of the paper. This device is being used by 90% of the Banks of Canada and the United States, as well as the treasuries of both countries. Write for full particulars and price. W. E. Parker & Co., Sole Canadian Agents, 37 Yonge Arcade, Toronto, Ontario.

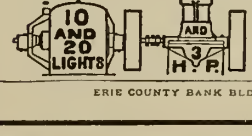
WE HAVE eight rebuilt Visible Oliver Typewriters for sale. The price is $30.00 each, and at that figure they are a bargain and should not be on the market long. Monthly payments can be arranged if desired. The Monarch Typewriter Company, Ltd., 98 King W., Toronto.

WHEN buying bookcases insist on having the best in the market—"Macey Sectional Bookcases." Carried in stock by all up-to date furniture dealers. Illustrated booklet sent free on request. Canada Furniture Manufacturers, Ltd. General offices, Woodstock, Ont. (tf)

## FIREPROOF SAFES, VAULTS, ETC.

IF YOU are in the market for a Safe or Vault Door, let us send you our illustrated catalogue "S." Our Safes are made to suit all requirements, from the smallest household Safe to the largest bankers' Safe made. The material and workmanship used in the construction of our Safes are the best obtainable. They are made to stand any fire through which they may be called upon to pass. Write to-day for book showing Safes which have passed through Canada's most severe fires. Address all inquiries to Dept. "S," The Goldie & McCulloch Co., Ltd., Galt, Ontario, Canada. (tf)


DYNAMO-ENGINE-SETS
FUEL-OIL- GASOLENE-ALCOHOL




THE BUFFALO MECHANICAL AND ELECTRICAL LABORATORY.
ERIE COUNTY BANK BLDG., BUFFALO, N. Y., U. S. A.

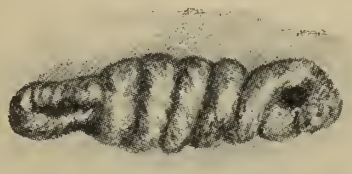
U.S. BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD

Pumping Machinery
We supply or erect complete plants for general
"Water Supply" or "Fire Service"

Pumps, Tanks and Supplies always in stock.

R. H. BUCHANAN & CO.
234 Craig St. West · · · · MONTREAL

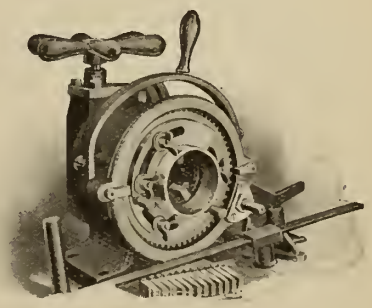
JOHN GARDE & CO.
142 Victoria Street TORONTO, ONT.
"Just around the corner from Queen and Yonge
Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND

SIMPLE, STRONG, COMPACT, DURABLE
And Easily Portable.



The Forbes Patent Die Stock
has revolutionized pipe cutting and threading methods.
CIRCULARS
THE CURTIS & CURTIS CO.
26 Garden Street,
BRIDGEPORT, · · CONN.

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1½" connections.
Write for pricea to Corbet Foundry and Machine Co., Owen Sound.

### For Sale

FOR SALE CHEAP FOR CASH—One 15 h. p. horizontal engine, second hand, made by F. Lowe & Sons. Ottawa. Apply to Marshall Rothwell, P.O. Box 1, Navan, Ont. (10)

### For Sale

FOR SALE or will grant exclusive right to manufacture on royalty Canadian Patent 115643 a necessary household article simple to make. Arthur Solomon, 211 Winslow Ave. Buffalo, N.Y. (11)

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base aupporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour. elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The MACGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBONTYPE PORTABLE BOILERS—7' each, 60 h.p.

HEINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five ye rs.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### Electric Lighting

THE town of North Battleford, Saskatchewan, th chief divialonal point on the main line of th Canadian Northern Railway ia open to grant franchiae for electric lighting. Address, J. A. Gregory Mayor.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12"x 12 M'Ewen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumps, second hand. Waterous Engine Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

### For Sale

One Westinghouse Generator, 54 k.w. Direct current, 125 volts, speed 850, complete with switchboard, instruments, etc. Best of order. Will sell reasonable. Mr. Taber, 444 Bathurst St., Toronto. (8)

### For Sale

Two Fitzgibbon Boilers for sale at a bargain. Are now carrying 70 lb. pressure. Would make splendid heating boilers. G. C. Mooring, 16 Pearl Street, Toronto. (9)

### For Sale

ONE 5 h.p. Cook vertical gasoline engine, double ignition, complete with tank, skids, and all accessories. A new engine at a bargain for quick sale. Kellogg & Co., 196 King St. West, Toronto.

### For Sale

Electric Motors. One 5 horse-power re-wound this year; also one single horse-power, slightly used; both direct current. Apply Box 93, POWER HOUSE, Toronto. (12)

## SOMETHING THAT WILL INTEREST YOU

¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

Nature has solved the problem of distribution. It uses a multitude of agents to effect the distribution of its products.

Nature does not expect every seed to fall upon fallow ground and to take root. But, it achieves a profitable percentage upon its distribution. This is all that an advertiser has to do to reap a profitable harvest on his outlay.

# PROFESSIONAL DIRECTORY

**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc., Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) Ass. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg., Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737, East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**W. N. DIETRICH**
ELECTRICAL AND MECHANICAL ENGINEER
16 St. Sacrament Street, Montreal
CONSULTING AND CONTRACTING
Supervision, Specifications, Plans, Tests, Reports, Etc.

HARRY A. MOORE — JOHN J. SCOLLAN
**MOORE & SCOLLAN**
ELECTRICAL AND MECHANICAL ENGINEERS
STEAM, ELECTRIC AND HYDRAULIC POWER
CONSULTATION, REPORTS,
ESTIMATES, PLANS, CONSTRUCTION, TESTING, ETC.
OFFICES: GUARANTEE BLDG., 43 KING ST. W.
TELEPHONE MAIN 445 — TORONTO, CAN.

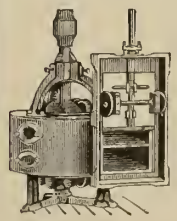
**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 2786

**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**Consulting and Supervising Engineers**
You should have your card appear regularly on this page—you may miss important engagements by not being represented.

**HERCULES Seamless Copper FLOATS**
**Are Absolutely Reliable**

We guarantee every one to give you entire satisfaction.
We will send you our new CATALOG "C" on request,
**Hercules Float Works**
P.O. Box 396. — Springfield, Mass.

**Improved "LITTLE GIANT" TURBINE WATER WHEEL**

Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. Highest effieiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine-cut Wood and Iron Tooth Gearing our specialty

THE

# Emil Passburg System

## Vacuum Drying and Impregnating

Dries and Impregnates electric cables, dynamo and motor armatures, field and magnet coils, etc. Impregnating compound enters the vacuum chamber without breaking the vacuum, thus eliminating the possibility of the dried coils re-absorbing moisture. The most economical and satisfactory Drying and Impregnating process known to science.

*All sizes and types. Write us for complete catalog*

**J. P. DEVINE CO.**
BUFFALO

POWER USERS, ENGINEERS OR CENTRAL STATION MEN wanting the name and address of the manufacturer of any class of power equipment, whether for steam, gas, or electric plants, will be able to obtain same by writing to the Editor of this journal. .:. .:. .:. .:.

Save Time in the Giving and Receiving of Orders

# Northern Electric Intercommunicating Telephones Will Do This For You

BECAUSE

You get instant communication between departments.

You have provision for emergencies.

You can be everywhere at once.

You have complete control of your entire plant.

Backed by our 30 years' experience and the most liberal guarantee.

Our experts are at your service—Don't put up any longer with unhealthy speaking tubes.

Northern Electric Intercommunicating telephones are simple in operation—reliable in service and inexpensive of installation.

Write for Bulletin 3113.

# THE NORTHERN ELECTRIC AND MANUFACTURING CO. LIMITED

Manufacturers and Suppliers of all apparatus and equipment used in the construction, operation and maintenance of Telephone and Power Plants

| MONTREAL | TORONTO | REGINA | WINNIPEG | VANCOUVER |
|---|---|---|---|---|
| Cor. Notre Dame and Guy Sts. | 60 Front St. W. | | 559 Henry Ave. | 918 Pender St. West |

# Packard TUNGSTEN LAMPS

THE MOST LIGHT FOR
THE LEAST MONEY

## The PACKARD ELECTRIC CO., Limited

Head Office and Works, - - - - - - - - ST. CATHARINES, ONT.
Branch Offices, - - - - - - - - - MONTREAL and WINNIPEG

# FERRANTI METERS

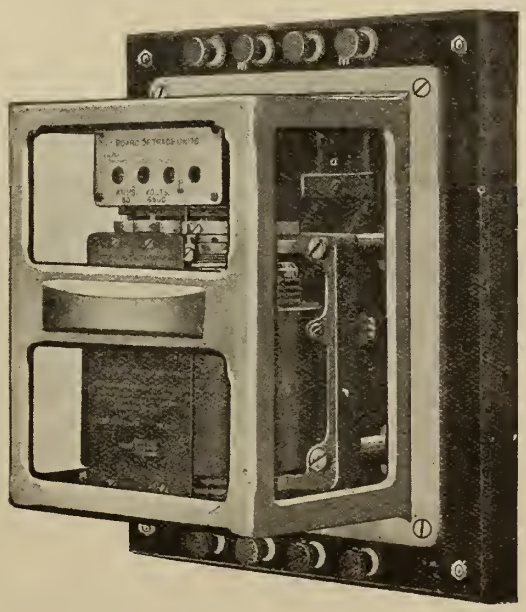
ALL TYPES
For A.C. & D.C. Currents

COMPLETE SWITCH BOARDS AND APPLIANCES

The Ferranti Meter fills all requirements.

Are known and sold the world over.

Remember, we manufacture a full and complete line of Switch Board Instruments, also furnish complete Boards, both High and Low Tension. : : : : :



Polyphase Meter, Switch Board Type

The Ferranti Leads!
"Why"?

It has a low starting current, accurate from 1/20 to 50% overload.

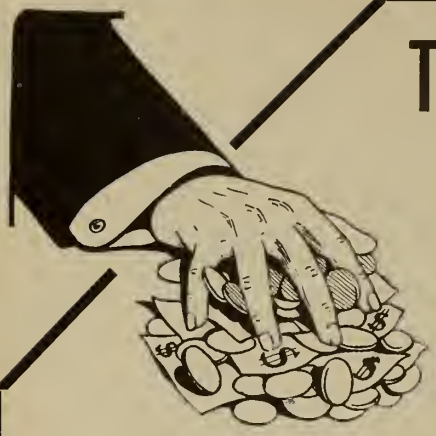
It has a low shunt loss.

No wear nor friction.

Send for our prices before purchasing. They will interest you.

Western Sales Office:
603 UNION BANK BUILDING, WINNIPEG
G. A. POWELL, Representative

Canadian Manager: G. C. ROYCE
22 Dundas St., WEST TORONTO



# THERE'S A HANDFUL OF MONEY SAVED

## Every Time You Purchase Renewed Lamps

When you buy a **New Lamp** you pay for the whole bulb from tip to socket.

But when you buy our **Renewed Lamps** you pay only for the new filament which we have placed within the bulb. And the renewed lamp is every bit as good as the newest lamp you can get.

By our expert method of removing burned out filaments and replacing them with new ones, we are able to offer you perfect lamps at a price that will add one hundred per cent. to the profits of your lamp department.

*This is a proposition worthy of your immediate attention. Write us for full particulars.*

**THE DOMINION ELECTRIC COMPANY**

ST. CATHARINES, ONT.

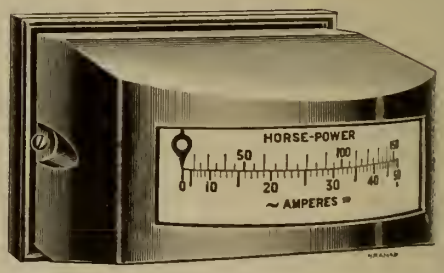
The sooner you commence buying RENEWED LAMPS the better for your profit and loss account. Start to-day!

# A.C. and D.C. AMMETERS and VOLTMETERS

## Direct Reading, Recording and Portable

WRITE FOR OUR NEW PRICES

OUR NEW PRICES ARE RIGHT




We Invite Your Inquiries.

**CHAPMAN & WALKER**

LIMITED

CORNER VICTORIA AND LOMBARD STREETS — TORONTO

# To the Central Station Engineers of Canada

A number of Central Stations have already requested our services for their *annual Fall preparation* for the heavy winter load, but there are a number of you from whom we have not heard.

We wish to thank those of you who have favored us with orders and also to assure the hesitant ones that their work will receive the same *careful and prompt attention* which has made our old customers our good business friends.

When sending in your work, we would be pleased to have your suggestions for changes your daily observation of the machine has shown necessary.

*REMEMBER*

## The Electrical Maintenance & Repairs Co.

**162 Adelaide Street West, TORONTO**
**Phone Main 3419**

*The Specialists in the Cure of Electrical Diseases.*

# The General Electric Manufacturing Co. of Sweden

**FOUNDED 1883**
**Factories in Westeras, Sweden; London, England; Helsingfors, Finland.**

**(ALLMANNA SVENSKA ELEKTRISKA)**

4,500 K.W., 257 R.P.M., 6,600 Volt., A.C. Generator, Water-wheel Type.

**Some reasons why you should consider our apparatus:**

- Moderate prices.
- All apparatus guaranteed during one year.
- 25 years of experience in the design and manufacture of electrical apparatus.
- Extremely rugged and reliable construction.
- Only best grade Swedish iron and steel used.
- Highest efficiencies.
- Spare parts carried in stock in Toronto.
- Our own skilled labor for erection and repairs.
- Actual shipping time only three weeks between factory and Ontario points.
- 3-Phase Motors in stock in Toronto.

*We solicit an opportunity of tendering on all your requirements.*

**REPRESENTATIVES IN CANADA:**

## Kilmer, Pullen & Burnham,

**508 McKinnon Building, TORONTO**

# ENGINEERS' SUPPLIES

J.M.T. Double extra heavy Y Blow-off valve, for marine service

## J.M.T.
## Y Blow-off Valves

have proved their efficiency and durability as a high-class valve for this service.

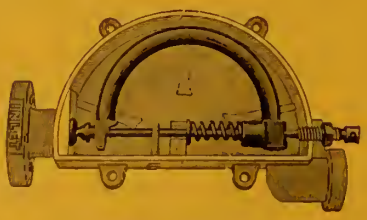
Engineers who have had these valves in use for years tell us they're the best "Blow-off" they've handled.

Made heavy pattern, with renewable disc, also with renewable seat and disc.

They don't require continual repairs and attention.

Standard J.M.T. Y Blow-off Valve.

The J.M.T. Standard Injector



The Heintz Steam Trap

A steam saving trap, wide open at 197° closes tight at 212° —

Send for circular.

J.M.T. Valves

The J.M.T. Standard Injector operates at pressures 20 lbs. to 160 lbs.

The Improved J. M. T. Injector operates from 20 lbs. to 220 lbs.

Results fully guaranteed.

J.M.T. Valves are made in standard and extra heavy patterns with Jenkins or Radium Renewable discs, also with copper disc for high pressure.

The Experienced Engineer knows that best results are ohtaired by the installation of steam goods made only of HIGHEST GRADE material and FULL WEIGHT design. If properly constructed for efficiency, and convenience in operation, his desires are fully met.

TRY J.M.T. lines of Steam Goods
A few of them referred to above

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

## The Jas. Morrison Brass Mfg. Co. Limited.
Toronto, Ont.

CIRCULATED IN EVERY PROVINCE OF CANADA

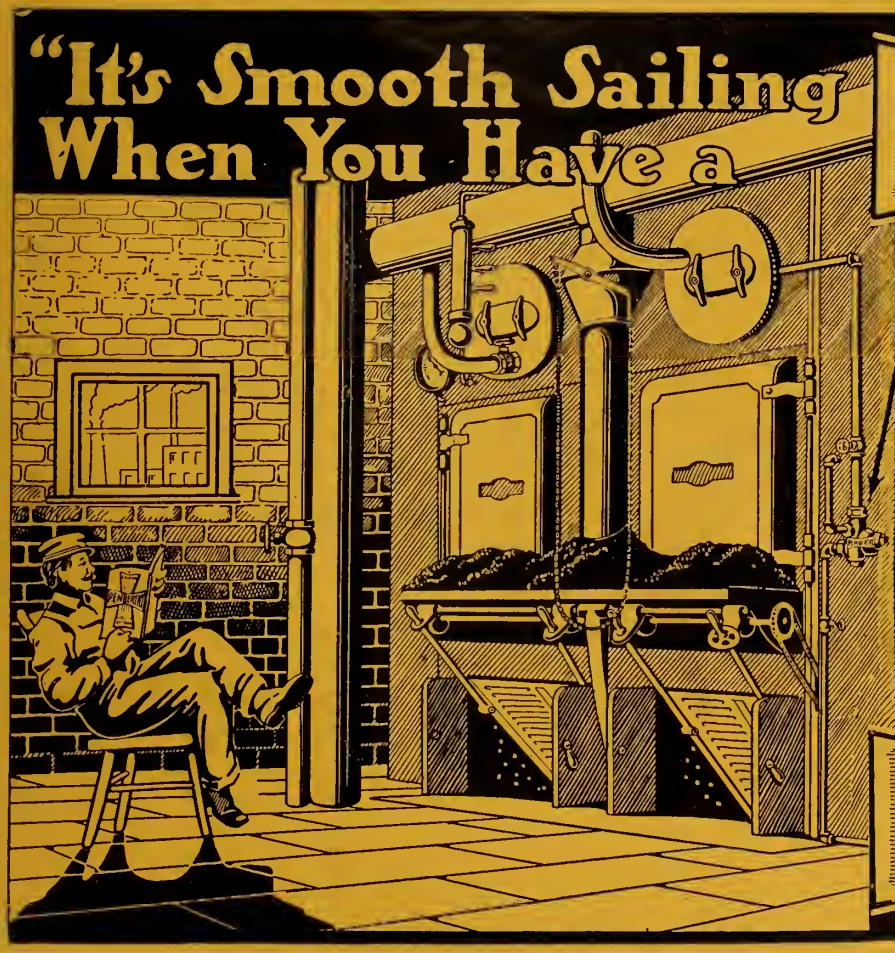
# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power; and to the operation of Refrigerating Machinery.
Published by The MacLean Publishing Co., Ltd.

MONTREAL: Eastern Townships Bank Bldg. TORONTO: 10 Front St. E. WINNIPEG: 511 Union Bank Bldg. LONDON, ENG.: 88 Fleet St., E.C

Vol. II. Publication Office, Toronto December, 1909 No. 12

"It's Smooth Sailing When You Have a



TRADE PENBERTHY MARK

The up-to-date Engineer doesn't want the

"JUST-AS-GOOD KIND"

he wants the best, that's

PENBERTHY

The Injector that's used exclusively by all leading engineers in Canada because

"THEY ALWAYS WORK"

TRADE PENBERTHY MARK

SUCCESSFUL ENGINEERS

DEMAND THE BEST EQUIPMENT FOR THEIR POWER PLANT.

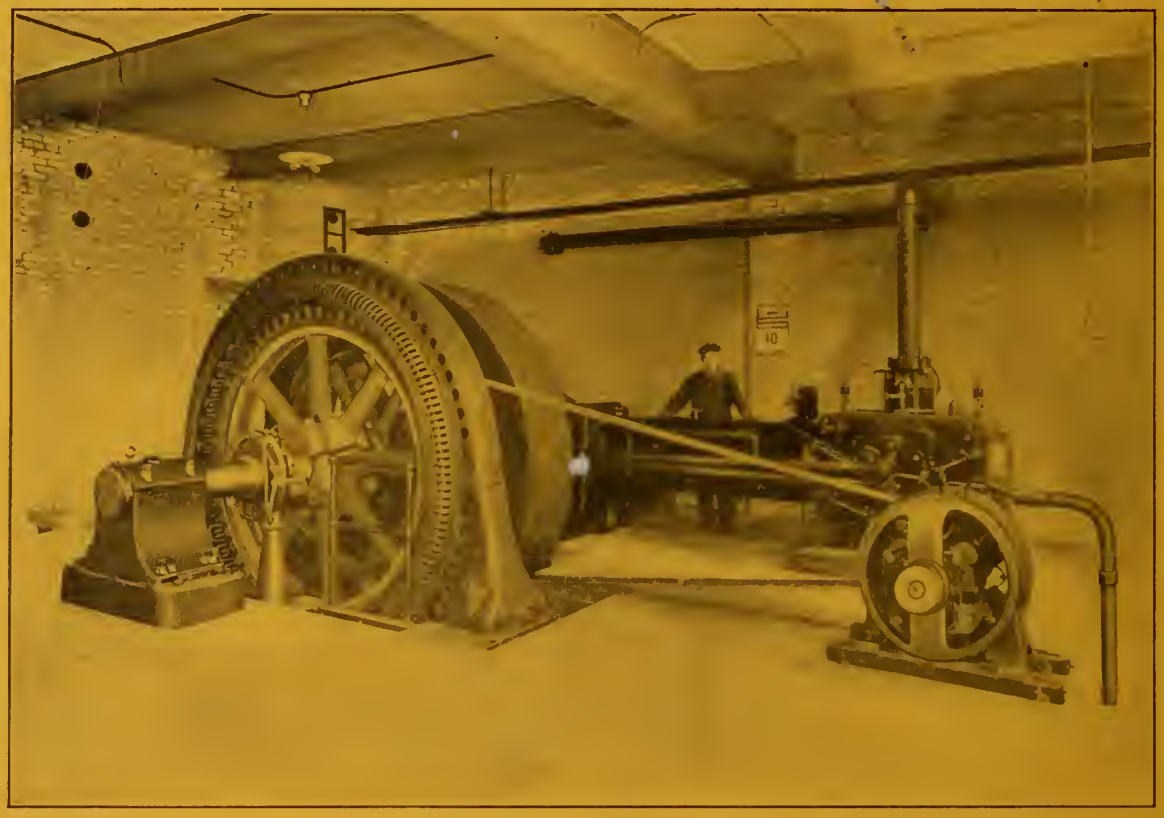
Don't risk YOUR engineering reputation by specifying cheap fittings.
It's the service you get from brass goods that determine their value.
That's why the "Penberthy Make" is so popular with engineers.
Refuse all Substitutes. Insist on getting the genuine Penberthy.

DID YOU GET YOUR WATCH FOB?

Every engineer sending his name and address and 15c. (stamps or silver) to pay merely for postage and packing will receive free by return mail a handsome Penberthy watch fob. Make yourself a Xmas Present. The supply is limited. Do it to-day.

PENBERTHY INJECTOR CO., Limited, WINDSOR, ONT.

# ELECTRIC PLANTS
## FOR
# LIGHT AND POWER

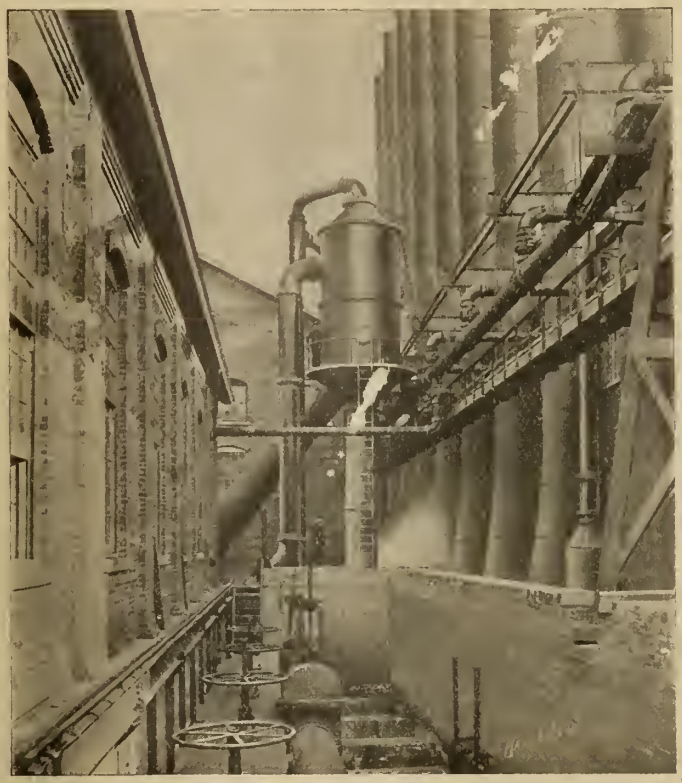


One of our 175 k.w. engine type alternating current generators in the power house of Somerville Limited, Toronto. For full description of this style of alternator see Bulletin 1048.

## ALLIS - CHALMERS - BULLOCK
LIMITED

**Works : Montreal**

***Sales Offices: MONTREAL, TORONTO, WINNIPEG, VANCOUVER***
***COBALT, CALGARY***



THE HELANDER

Counter Current

PATENTED

# Barometric Condenser

FOR

## CENTRAL CONDENSING SYSTEMS

LARGE SINGLE UNITS
STEAM TURBINES

In sizes for plants developing from 400 H.P. up.

Can be operated with or without air pump.

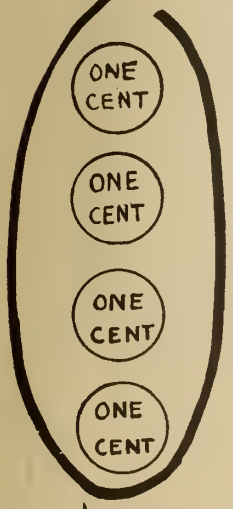
In saving in coal cost alone this condenser will positively more than pay for itself in the first year of its installation.

Plans and Estimates Furnished on Request

**THE WATEROUS ENGINE WORKS CO., Limited**

Vacuum and Centrifugal Pumps — BRANTFORD, CANADA

*Four Cents a Pound*




# What Do You Pay For BOILER COMPOUND?

## Look Here! Read These Facts!!

1. A 5-lb. bag of RED STAR CONCENTRATED COMPOUND at 16c. a lb. costs 80c.
2. Dissolved in a gallon of hot water, this bag makes 21 LBS. of LIQUID COMPOUND, having a much greater specific gravity than that of any Liquid Compound of which we know.
3. This 21 lbs. of Liquid Compound, divided by 80c., its cost in powder form, is 3.80c., or less than 4c. a pound.

Have you been paying more than 4c. for liquid compound? Do you realize that when you pay freight on liquid compound you are paying freight on weight of which by far the larger pe .cent. is plain water? Don't be "stung" on liquid compound buy—RED STAR CONCENTRATED COMPOUND. It is the cheapest and best. It is only made up after chemical analysis of the feed water to which it is to be applied, and we absolutely guarantee RED STAR C MPOUND to free any boiler from all old scale and to prevent the for. mation of any new scale. If it fails we will refund every cent of the purchase money and pay freight both ways-

*Express us a gallon of your feed water for free analysis.*

**Hygienic Laboratories, Limited** 11 Colborne St. TORONTO, ONT.

The advertiser would like to know where you saw his advertisement—tell him.

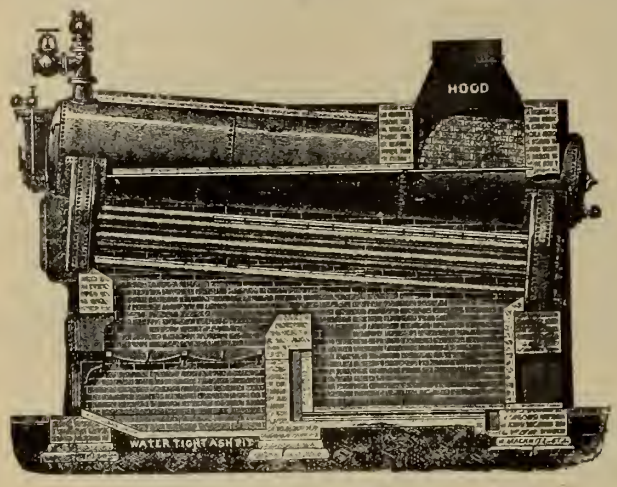



Fig. 1—Heine Boiler and Setting

# The Reason Why

so many of the largest Power Plants in all parts of the world have installed the

# Heine Safety Boiler

is because in point of efficiency, economy, durability and safety, it is without a peer.

The HEINE BOILER is economical because it delivers dry steam at the piston by separating all water from the steam. Moreover, it has wonderful capacity for rapidly absorbing and transmitting heat.

The HEINE DRUM is a specialty of this boiler, which effectively precipitates and discharges all scale and mud.

Absolute safety at the highest pressures is assured to users of the Heine Boiler. Every conceivable test is applied both to the plates, etc., and to the completed boiler.

We have literature which will interest you. Write us.

125,000,000 horse power of HEINE BOILERS in use in United States at the present time.

## POLSON IRON WORKS
**LIMITED**

## TORONTO, CANADA

Agents for Quebec :
Watson Jack & Co., 709 Power Building
Montreal

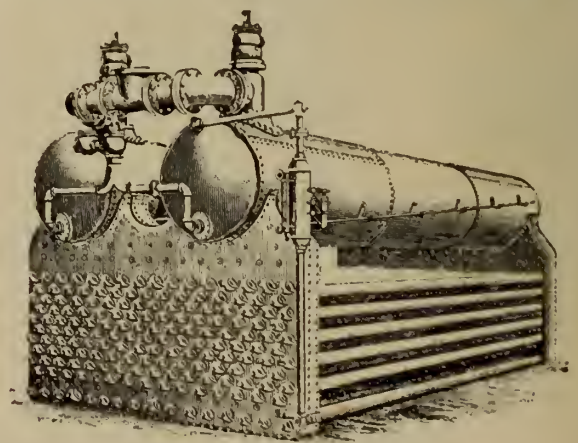
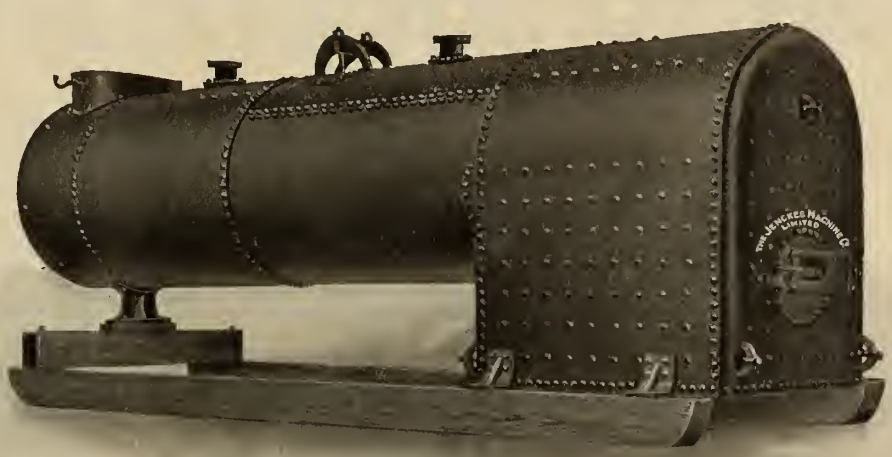


Fig. 2.—The Heine Boiler Without Brick Setting

# Locomotive Type Boiler—Class "D"

Write for Prices



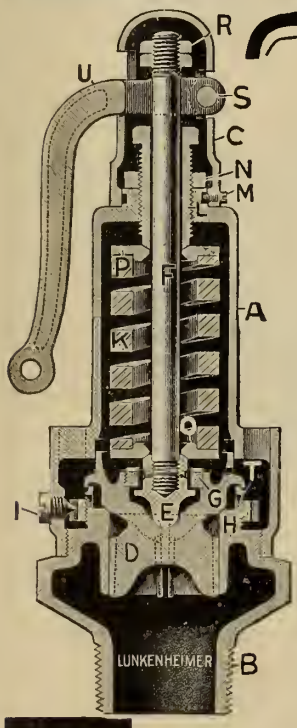
Write for Catalogue

OPEN BOTTOM PATTERN

## THE JENCKES MACHINE COMPANY, Limited

GENERAL OFFICES: Sherbrooke, Quebec WORKS: Sherbrooke, Quebec; St. Catharines, Ontario

SALES OFFICES: Sherbrooke, St. Catharines, Cobalt, Vancouver, Montreal




WHEN SELECTING A POP VALVE FOR STEAM BOILERS, ASK YOUR DEALER FOR ONE THAT HAS FULL RELIEVING CAPACITY, THAT DOES NOT STICK, CHATTER OR POUND, AND IS POSITIVE IN OPERATION —OR SIMPLY ASK FOR A

## LUNKENHEIMER "POP" SAFETY VALVE

THEY ARE UNIVERSALLY ACKNOWLEDGED THE BEST MADE IN EITHER BRASS OR IRON BODY FOR WORKING PRESSURES UP TO 250 LBS. PER SQUARE INCH.

WRITE FOR CATALOGUE.

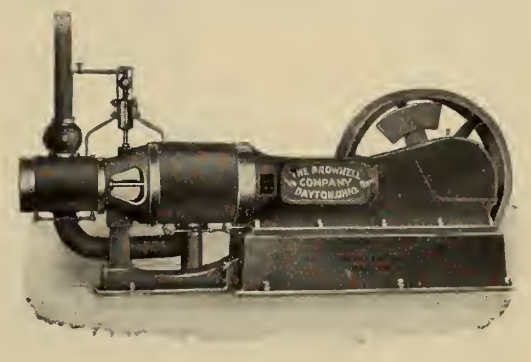
## The LUNKENHEIMER CO.

LARGEST MANUFACTURERS OF HIGH-GRADE ENGINEERING SPECIALTIES IN THE WORLD

General Offices & Works, CINCINNATI, Ohio, U.S.A.

BRANCHES { New York, 66-68 Fulton St.
Chicago, 32 Dearborn St., Cor. Lake
London, S.E., 35 Great Dover St.

41




## The Brownell Company

Dayton, · Ohio

Branch Offices:

401 Bank of Commerce Bldg., St. Louis, Mo.

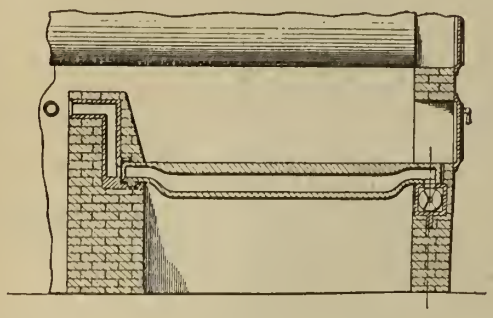
925 Monadnock Bldg., Chicago, Ill.

Manufacturers of

**Boilers, Engines and Feed Water Heaters**

We make a specialty of Enclosed Splash Oiling Engines for Direct Connecting to Generators.

# FLEMING GRATE BARS



save money by utilizing what is now going to waste. Diamond Smoke Consumer is worth your consideration.

WRITE FOR PARTICULARS TO

## BUTTERWORTH FOUNDRY, LIMITED

BROAD STREET : OTTAWA

or to F. W. Donaldson, 422 Euclid Avenue, Toronto

NEW MODEL

## Diamond Shaking and Dumping Grate Bar

Brick Yard Castings at Lowest Prices

Canadian Patent 118778

Boiler Room Supplies of All Kinds

**The Diamond Grate Bar** is protected by Letters Patent and all our customers can be assured that they are getting the most up-to-date Shaking and Dumping Bar in the market to-day. We don't claim that our bar is everlasting, but we do claim that, with ordinary care, it will last longer than any other and burn all grades of fuel with good results.

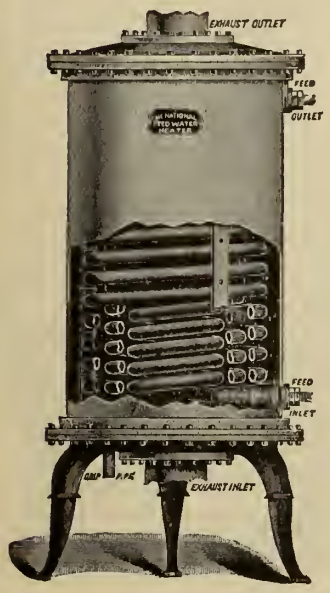
## The Diamond Grate Bar Co.

Head Office:
BERLIN, ONT.

Branch:
Room 119 St. James Chambers
Tel. M. 1342 TORONTO

# The National Feed Water Heater

## Thousands of Horse Power in Use in Canada




The reason more National Feed Water Heaters than any other make have been sold in the past twenty years is because they are more practical and efficient.

Their construction is **simplicity itself.**

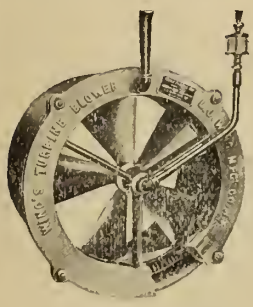
From one to fourteen coils of **seamless drawn** brass or copper **tubing** are encased in a **cast-iron or steel shell** to which **exhaust steam** is admitted, heating the water passing through the tubing. All joints are brazed—**leaking is impossible.** There is no boiler pressure on the shell at any time and the **shell never wears out.**

There is an interesting catalog of the National Feed Water Heater which you may have for the asking. **Write for it to-day.**

## THE NATIONAL PIPE BENDING CO.

91 LLOYD STREET

New Haven, - - - Connecticut



EXTERIOR VIEW

INTERIOR VIEW

## "WING BLOWERS"

FOR FORCED DRAFT

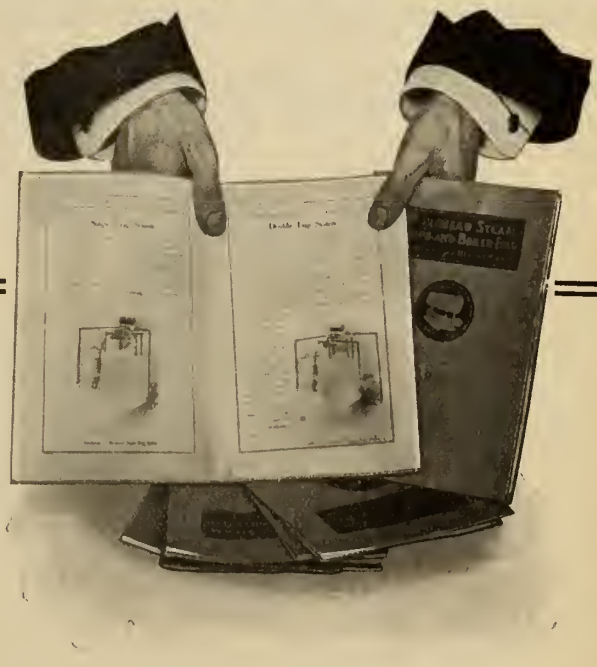
MADE BY

## RUSSEL & GIFFORD

MONTREAL TORONTO

ALSO AGENTS FOR

## "BUNDY TRAPS"



## Just a Postal

advising your name and address will bring this fully illustrated and instructive "Steam Trap" book direct to you. Write to-day as the edition is limited.

**MOREHEAD MFG. CO.,** 1021 Grand River Avenue DETROIT, MICH.

Canadian Representatives
A. R. WILLIAMS MACHINERY CO., Toronto, Ont.
W. H. MARKLE, Montreal, Que.
PARK BROS., Chatham, Ont.

The advertiser would like to know where you saw his advertisement—tell him.

# Prove this Packing Yourself ! !

and the best way to do that is to pick out the joint that has been giving you the most trouble. Having decided on your "hoodoo joint," tear out this ad. and write your name and address in the margin. Send the result to us, and we will send you a free sample. You apply it to that joint and —exit hoodoo.

You are placed under no obligations and you get a tight joint.

Moreover, this packing is absolutely guaranteed, and if you order any and are dissatisfied, say so and get your money back. If you use the packing, IT pays for ITSELF in efficiency and length of service.

*Here's the margin*
*Where's your pen?*

## YOU Win Both Ways.

When sending this ad. for a free sample, ask for Valve Catalog.

## Jenkins Bros., Limited

102 St. Remi St., Montreal

# *Put in the*

# DART UNIONS AND FLANGES

## *first and they will always last*

The joint is BRONZE to BRONZE and will not rust nor corrode—There is no packing used. Every dart has the name cast on it and is guaranteed.

*ALL DEALERS*

## DART UNION CO., LTD. - - TORONTO ONTARIO

# Practise Economy

by utilizing the exhaust from either Steam or Gas Engine to HEAT WATER!

Do you realize that you are only getting the use of 30% of the heat value of the gas in your engine? You can utilise a large part of the heat now being wasted by installing a

## Transverse Current Water Heater

**Some facts concerning this heater. Do they interest you?**

¶ Being made of cast iron it does not readily corrode and is not affected by electrolysis or acids.

¶ Has all the good features of both the closed and open type of heaters —no tubes to scale, no joints to leak, no floats to require attention.

¶ It is practically self-cleaning, as scale does not readily adhere to cast iron. The water passages are all easily accessible for cleaning if necessary.

¶ No Oil Separator needed and can't possibly get out of order.

**Send for Complete Descriptive Booklet.**

## THE RIBLET HEATER COMPANY

**Box 18, - ERIE, PA., U. S. A.**

MORE POWER FOR THE SAME MONEY OR THE SAME POWER FOR LESS MONEY

## TURBO-BLOWER

## BURN CHEAP COAL and INCREASE POWER

These two results can be obtained through the use of the **Turbo-Blower.**

This machine is simple in construction, low in price, positive in results and can be readily installed in **any type** of **boiler** by an ordinary mechanic.

We'll be glad to explain fully

**Just write "Catalog."**

**TURBO-BLOWER CO.** 30 CHURCH ST. NEW YORK, N.Y.

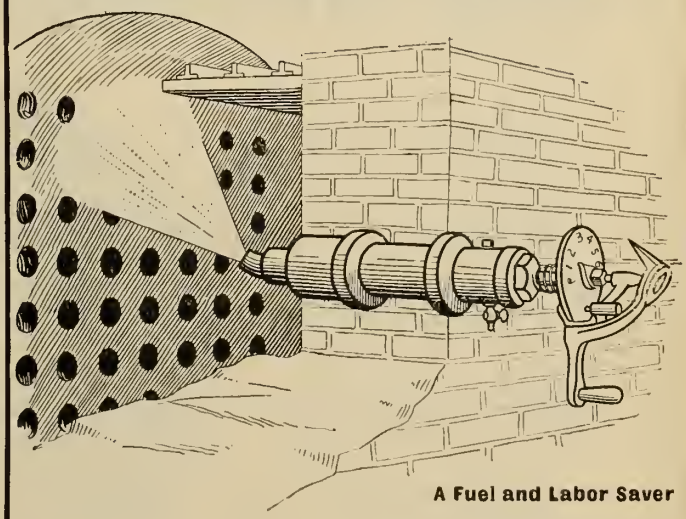
For Eastern Canada:

W. H. Adams - - - - 102 Nazareth St., Montreal

For Western Canada:

Standard Engineering Co., Ltd., 47 Wellington St. E., Toronto

## Diamond Steam Flue Blower



**A Fuel and Labor Saver**

450 blowers sold to one manufacturing corporation for its various plants---

There *must* be *good* reasons.

It saves its cost in a short time and continues to pay dividends as long as used. **Sent on thirty days' trial.**

## Diamond Power Specialty Co.

**317 Fort Street W., Detroit, Michigan**

The advertiser would like to know where you saw his advertisement—tell him.

# COAL

## Jules G. Hoffman

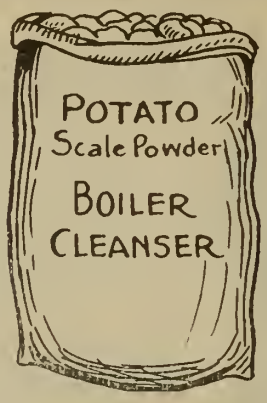
Miner and Shipper
of

**High-Grade Steam & Gas Coals**

**Blacksmith Coal & Coke**

Quality Guaranteed

General Offices - - 420-423 Hammond Bldg.
Detroit, Michigan, : : : U. S. A.




Think What This
Means To You

Every time any scale forms on your boiler, more coal must be used to heat the scale before it heats the water.

Then, too, there is the expense of cleaners, cleaning and time lost in the operation.

So that if you can get rid of your scale, it means less coal for the same amount of steam evaporated, and no expense for tube cleaners. My

**Potato Scale Boiler Cleanser**

will positively obviate scale in your boiler without doing damage to shell, pipes or connections.

Mail me a sample of the water you use, and I will prove I can make good my statements.

SOLE AGENT FOR AMERICA.

C. C. SNOWDON

Wholesale Oil Merchant — CALGARY, Alta.

Branch Stores in New York and Montreal

Address all letters to Calgary.

# "By the way" have you tried our

Harris Heavy Pressure-Bearing Metal?

You will never regret a trial order.

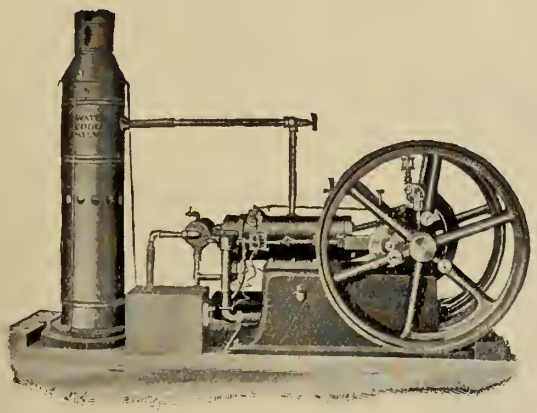
Price 22c. per lb.

Manufactured and Guaranteed by

# The Canada Metal Co., Ltd., Toronto

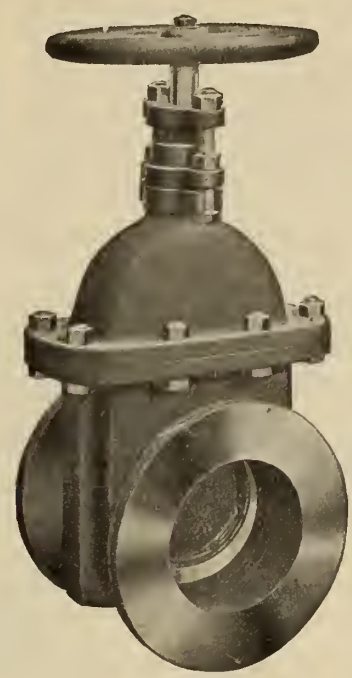
# GAS and GASOLINE ENGINES

## 1½ to 25 H.P.



If interested it will pay you to write for our Catalogue

**Goold, Shapley & Muir Co.**
Limited
BRANTFORD - CANADA



## KERR GATE VALVES

*are to be found in all well equipped steam plants in Canada.*

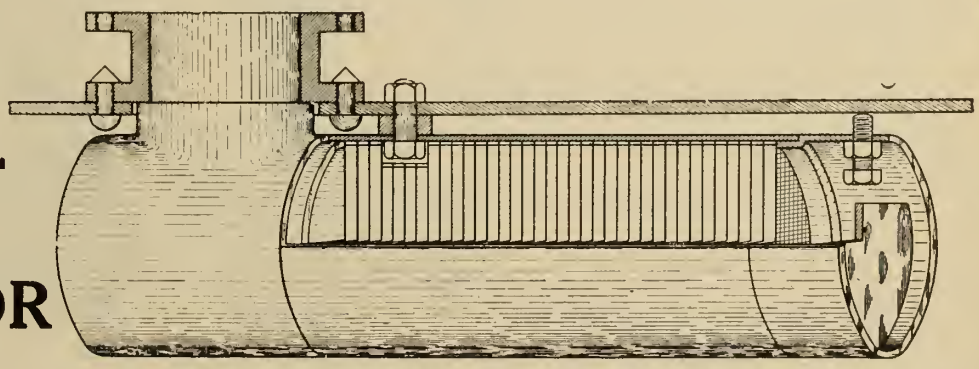
*The valves with a good reputation are those you should buy.*

*Write for our Catalog of High Grade Brass and Iron Valves.*

**The Kerr Engine Co., Limited**
*Valve Manufacturers*
*Walkerville, - Ontario*

# WET STEAM IS UNNECESSARY, EXPENSIVE AND DANGEROUS!

## IDEAL INTERNAL STEAM SEPARATOR



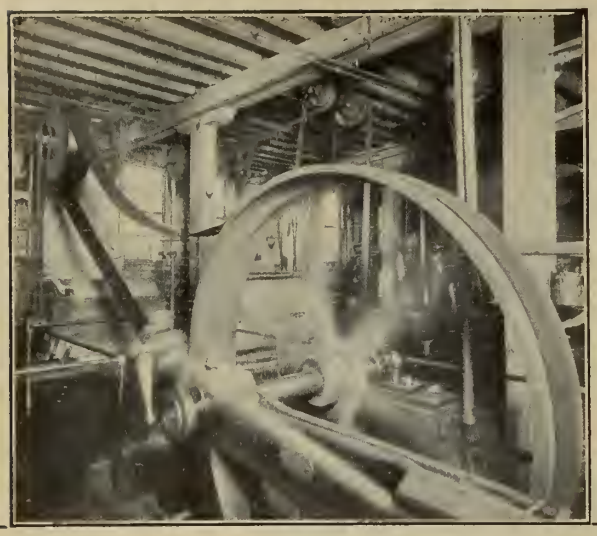
Absolutely safeguards your engine against damage through water-shock or the going-out of cylinder heads. It makes for economy by saving oil, packing and time, and by lessening the wear and tear of engines, pumps and compressors. Remember the first cost is the only cost! The "Ideal" requires no subsequent attention.

*Other lines, each having distinctive features:*
POTTER SEPARATORS; WHALEY AUTOMATIC SMOKE PREVENTERS; LEONHARDT GAUGE GLASS PROTECTORS
*WRITE FOR DETAILS AND PRICES*

*We are Selling Agents for:*
WATSON & McDANIEL CO., Philadelphia, (Steam Traps, etc.)
SIMS' FEED WATER HEATERS, Erie, Pa.;
HARRIS SMOKELESS FURNACE CO., Nashville, Tenn.
*WRITE FOR CATALOGUES*

## IDEAL STEAM SEPARATOR AND SUPPLY CO.

820 Euclid Avenue, TORONTO, Canada



# Cling-Surface
## For Canadian Belts

There is, without doubt, more Cling-Surface used in Canada than the total of all other materials.

Because only Cling-Surface will permit all belts and ropes to be run easy or slack and carry full loads, and at the same time make and keep them pliable, water-proof and preserved.

It contains no rosin and is not sticky, but penetrates *into* the belts and ropes, where they need it.

The running of belts slack means ease on belts, bearings, shafting and engine, cool bearings, economy of oil, saving of the time and labor in keeping belts tight and increased power at machines.

This belt has run 6 years in the I.X.L. Laundry, Toronto, with Cling-Surface, in heat and steam. It is 9" leather, 8' to 42" pulleys, 17' centers, 45 H.P. load when photographed, 2050 ft. P.M. 40" slack, and never slips.

We guarantee Cling-Surface to give you the best belt service you ever had. We quote f.o.b. Toronto, duty paid. Write for special trial terms and printed matter. Write now.

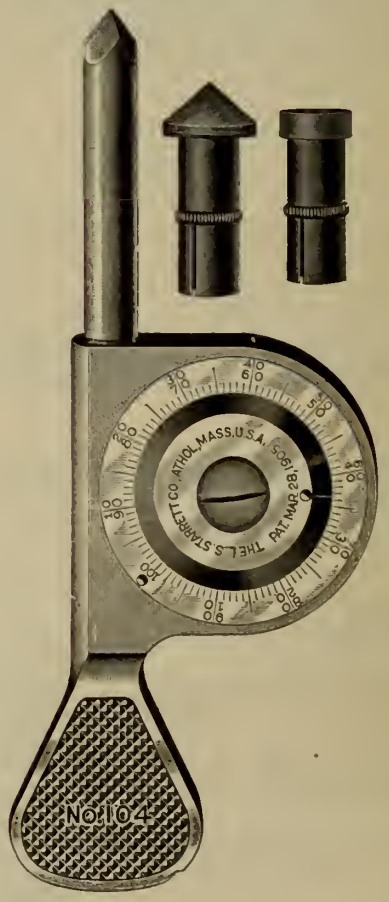
**Cling-Surface Company**

1057 Niagara Street, Buffalo, N.Y.

# You May Have One of these Speed Indicators without Spending a Cent

if you are a subscriber to "THE POWER HOUSE," by sending two new paid-up subscriptions ; If you are not a subscriber, send in your own subscription together with two others, and the indicator will be mailed to you immediately.

**STARRETT HIGH SPEED INDICATOR, No. 104**
**Value $1.00**
**Given for two yearly paid-up subscriptions.**

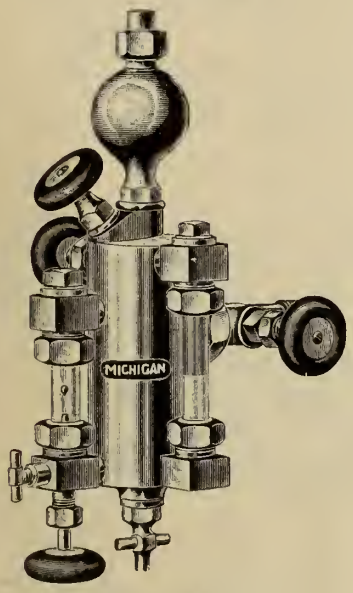



"THE POWER HOUSE" is designed to give Canadian Engineers, Superintendents and Power Users all the latest and best information in the engineering field. A little work among your engineer friends and acquaintances will earn for you one of these handy indicators without any trouble. Try it and see how easy it will be.

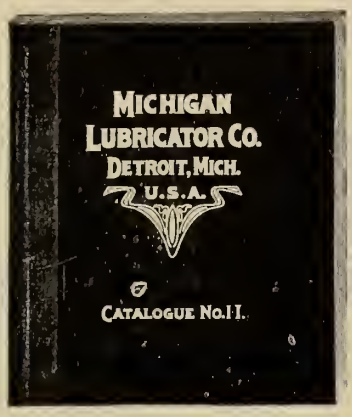
**PUBLISHED MONTHLY AT $1.00 PER YEAR.**
**Start in TO-DAY to earn one of these handy Tools.**

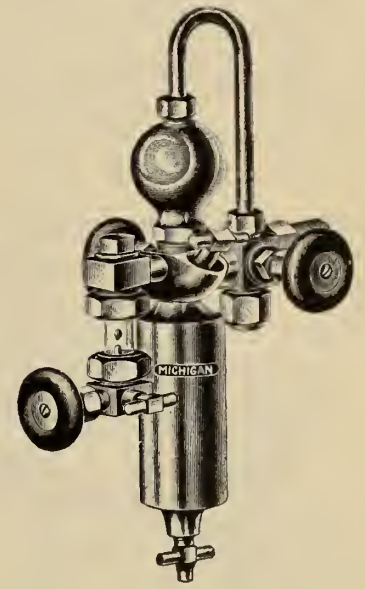
**THE POWER HOUSE**
**10 Front Street East TORONTO**

# MICHIGAN




Illustrated catalog mailed to you free




WRITE TO-DAY

## MICHIGAN LURICATOR CO.

DETROIT, MICH.

## EVERY ENGINEER

## SHOULD KNOW

ALL ABOUT

**WEARWELL** LEATHER PACKINGS

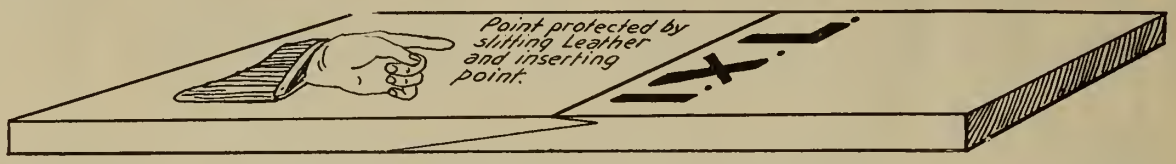
You have packing troubles and have never known where to procure Packings that would give satisfactory service. We manufacture "Wear Well Leather Packings" from the highest quality of leather, work to your specifications and guarantee every Packing to give satisfaction.

Made in all sizes and styles for use in Hydraulic and Compressed Air Machinery. Write for descriptive booklet.

## Detroit Leather Specialty Company, Inc.

DETROIT 87 Beecher Avenue MICHIGAN

# THE "I.X.L." SPLICE "THE BELTING SPLICE THAT WILL NEVER COME OPEN"




The great trouble with *any* belting—no matter how good the leather—that is joined up with the ordinary splice, is the fact that the splices come open, causing loss and delay. J. D. McArthur's Leather Belting made with the "I.X.L." SPLICE, as shown in this cut, *cannot* come open at the splices. Note the protected point, outside point running same direction as pulley.
J. D. McArthur's Leather Belting is made from Prime British Oak-Tanned Leather, from Close-Trimmed Backs exclusively.

Write for our complete price list. J. D. McARTHUR & CO., Brockville, Ontario

Stock at Toronto Branch 639 King St. East; J. E. Stephenson & Co., Agents

# Sadler & Haworth

ESTABLISHED • 1876

"CLIMAX" In Oak Tanned Leather Belting These Brands Are the Best. "AMPHIBIA" (WATERPROOF)

Factories at Montreal and Toronto - Stock Depots: St. John, N. B., Winnipeg, Calgary, Vancouver

# When You Think of BELTS

Think of the Brands

# "EXTRA" "STANDARD" "ACME WATERPROOF"

## When You Want Prices

Write to the makers

# J. L. GOODHUE & CO., DANVILLE, P.Q.

## Who turn out the highest quality of Leather Belts by using

Experience, Expert Workmanship, Slow Process Tannage and Selected Hides

*FOR THE*

**Most Effective and Economical POWER TRANSMISSION**

*USE*

**PHILIPS' PRESSED STEEL PULLEYS**

*AND*

# D. K. McLAREN'S

## *GENUINE BRITISH OAK TANNED*

# LEATHER BELTING

D. K. McLaren Belting is made exclusively from close trimmed centres of the very highest quality hides. Our tanning process is the Genuine British *Oak* Method—not to be confused with inferior hemlock processes to which the name "Oak Tanning" is frequently and *wrongfully* given.

Our regular lines are

**EXTRA "C" and STANDARD "B"**

They are the best belts on earth for all general purposes.

**SPECIAL BELTS MADE TO ORDER**

*Write for our price lists*

## D. K. McLAREN, LIMITED

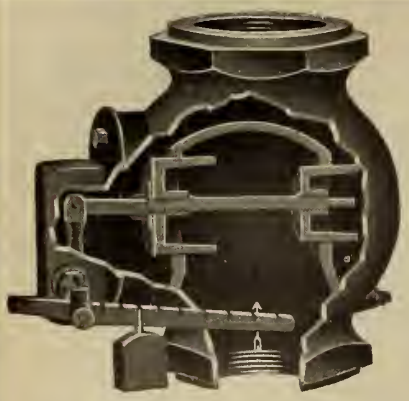
MONTREAL
309-11 Craig Street West

TORONTO
200 King Street West

QUEBEC
21 St. Peter Street

ST. JOHN, N.B.
64 Prince William Street

VANCOUVER, B.C.
418 Abbot Street



## Noiseless Back Pressure Valve

The great improvement made during the past year in modern steam heating has created a demand for a high-class **Back Pressure Valve.**

Our **Improved Double Seated Valve** operates equally as well with eight ounces or five pounds back pressure.

Every valve is tested and the **valve seats are ground in under steam pressure.**

We carry in stock all sizes from 1½-in. to 14-in.

☛ *If interested write for Pamphlet "D."*

**DARLING BROTHERS, Limited**

Head Office and Works, 15 Ottawa St.

TORONTO MONTREAL WINNIPEG

This

## Steam Trap

is made under the personal supervision of the originator and inventor of the First Return Trap. All his experience and trap wisdom is embodied in each and every

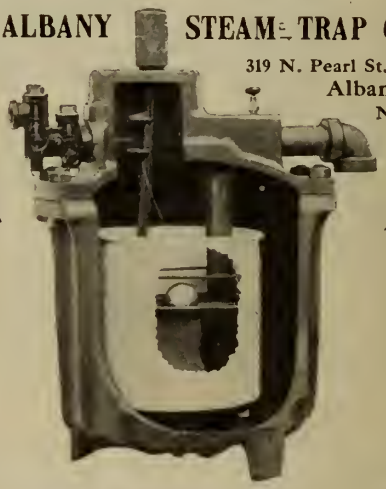
**ALBANY STEAM TRAP**

on the market. It is the trap nearest perfection, the result of 40 years' concentrated effort along one line.

CATALOG ?

**The ALBANY STEAM TRAP CO.**

319 N. Pearl St.
Albany,
N.Y



# Quality—Efficiency—Reliability

**These, together with reasonable cost, have established the reputation of**

**Mason** Reducing Valves, Pump Pressure and Speed Regulators, Damper Regulators, Balanced Valves.

**Reilly** Multicoil Feed Water Heaters, Condensers and Evaporators—the most compact and efficient.

*It is not what you pay for an article, but what the article pays you in return for its cost, that determines its real value. . . . . .*

(Genuine) **Ashton** Pop Valves, Relief Valves, Pressure & Vacuum Gauges, Alarm Gauges.

**Berry** Safety Automatic Boiler Feed Control—the simplest and best.

## Bundy Steam Traps and Separators

**We design complete systems for returning condensation direct to the boilers, and we can effect economies in most steam plants.**

*Catalogues and full information are at your disposal.*

**PEILER & MACKENZIE, -** 52 St. James Street MONTREAL

"HERE'S THE POINT"

In an Oiling System where trouble often begins with clogged valves—dirty leaking or broken sight feed glasses—one of these plain, neat Richardson Sight Feeds will fill all requirements efficiently.

They are made for one, two, three or four pipe connections—Union-Cinch type—(Bulletin No. 210). May be placed in series or at the end of the pipe lines.

Advance Sheet No. 114.
Something Interestingly new!

THE SIGHT FEED OIL PUMP CO.
MILWAUKEE, WIS.

TEN IT's
WHY YOU SHOULD USE
Walker's Electric Boiler Compound

1. It saves Labor.
2. It saves Fuel.
3. It saves the Boiler.
4. It is the cheapest on the market.
5. It perfectly cleans the Boiler and Tubes.
6. It dissolves Lime and Sediment.
7. It will not injure the Irons, Packing or Connections.
8. It prevents Foaming.
9. It prevents Explosion.
10. It is manufactured for the different water.

**Walker's ELECTRIC BOILER COMPOUND** is put up in the following sized packages:

Barrels, 400 to 500 lbs., **5c.** per lb.
Half Barrels, 250 to 330 lbs., **6c.** per lb.
Kegs, 100 to 110 lbs., **7c.** per lb.

Electric Boiler Compound Co., Limited
GUELPH, ONTARIO

STERLING FORCE FEED LUBRICATORS

THEY WON'T

WASTE OIL IN THE DROP PER MINUTE SYSTEM.

THEY WILL SAVE

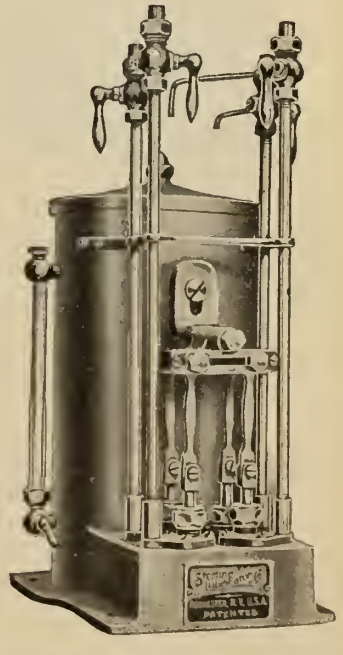
30%—THIRTY PER CENT.—30%
OVER HYDROSTATIC LUBRICATION.

YOU SHOULD

INVESTIGATE ASK INQUIRE
30 days' free trial

WE WILL

SEND SPECIAL SOUVENIR INFORMATION, DISCOUNTS, ETC.



SCOTT, CAMPBELL & CO., 65 VICTORIA ST. Phone M. 4034
AGENTS FOR
STERLING LUBRICATOR CO.
"8 FRANK" STREET, ROCHESTER, N.Y.

***We Want To Prove***

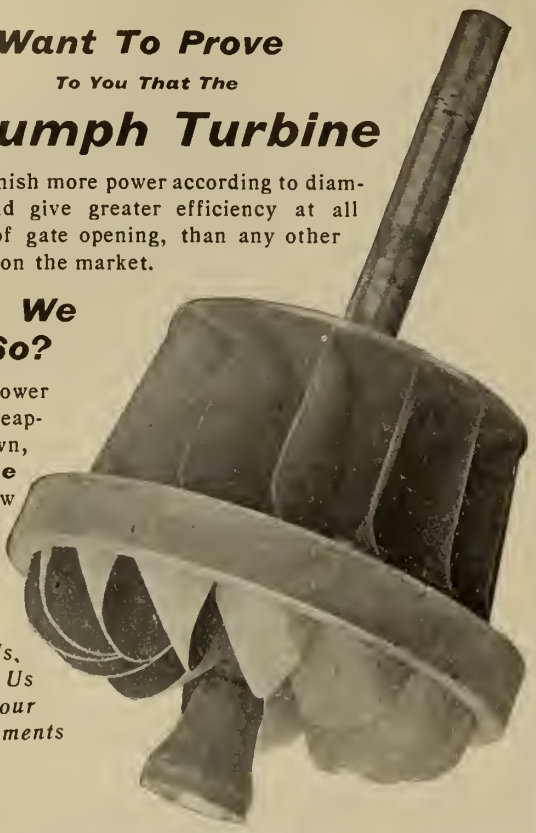
*To You That The*

## *Triumph Turbine*

will furnish more power according to diameter, and give greater efficiency at all stages of gate opening, than any other turbine on the market.

***May We Do So?***

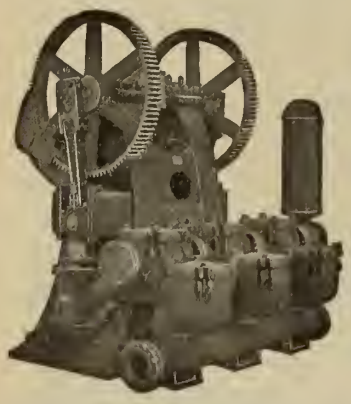
Water power is the cheapest known, and *we* know how to harness it!



*Write Us, Telling Us What Your Requirements are.*

**THE MADISON WILLIAMS MFG. CO. LIMITED LINDSAY, ONT.**





## On Account

of their

Extremely Low Cost of

Operation and the Small

Amount of Attention

Required

# Goulds Efficient Power Pumps

are growing in favor wherever they are installed. Let us send you catalog of Pumps for every service.

**Goulds Pump Co.**

Coristine Bldg., Montreal

**Phone Main 1054**

*Works - - - - - Seneca Falls, N.Y.*



# CANADIAN ASSOCIATION of STATIONARY ENGINEERS

**TO THE STATIONARY ENGINEER WHO IS NOT A MEMBER OF THE C.A.S.E.:**

Can a true, progressive engineer afford to be outside of our organization ?

Remember that we will give methods of improvement to all our members desiring them.

If you are interested in such an association as ours and live where there are less than fifteen engineers located, send for our prospectus and a constitution and apply for admission at the nearest lodge. If you live in a town where there are fifteen or more engineers, get together and send in a written application for a charter.

The engineer of to-day, if he is a progressive one, is much interested in securing the passage of laws which compel the engineer to give evidence of his fitness to act as such.

**W. A. CROCKETT**

**Executive Secretary**

**MT. HAMILTON, - ONT.**

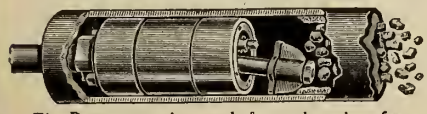
# ECONOMY IN BOILER MANAGEMENT

depends upon the method of boiler cleaning employed. Perhaps you'd like to know how to promote economy in YOUR Boiler room. We've been in the boiler cleaning business 12 years and we think we know a few things along this line which you may not. For instance, we have learned that compounds neither prevent nor remove scale. Then we know that

## The Dean Boiler Tube Cleaner

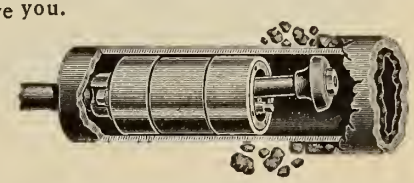
will remove enough additional scale from the boilers you think clean to save its cost in six months or less. You may never know how much you are losing because of scale until we show you how much we can save you.

**Write to-day for "Scale Removal Made Easy" and our free trial offer.**



The Dean removing scale from the tube of a water tube boiler.

**THE WM. B. PIERCE CO.**
330 Washington Street, Buffalo, N.Y.



The Dean removing scale from the tube of a return tubular boiler.

# The Nichols Chemical Company, Limited

HEAD OFFICE: 222 ST. JAMES ST., MONTREAL

# ACIDS AND CHEMICALS

WORKS:
Capelton, Que.
Sulphide, Ont.
Barnet, B.C.

**TRI-SODIUM PHOSPHATE**
Purest Commercial, 100%, for prevention of scale in boilers.

WAREHOUSES:
Toronto, Ont.
Montreal, Que.

# "STEEL MIXTURE"

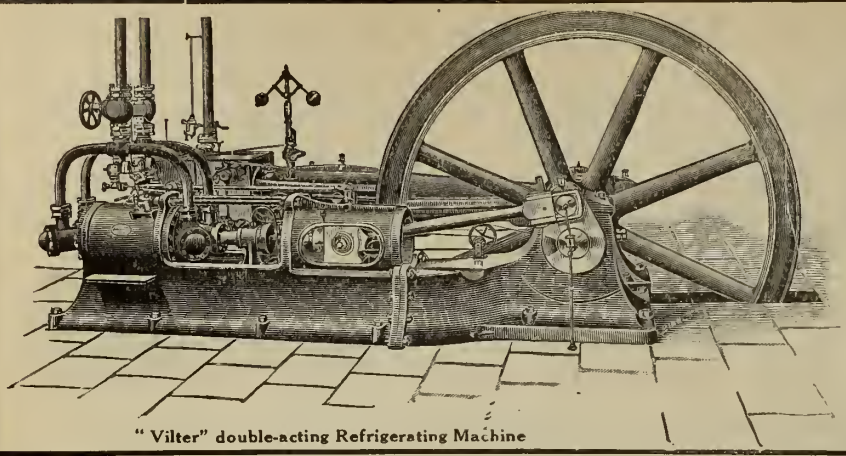
The ideal material for boiler settings. It is hard as well as heat resistent. Our large stock, from which we can ship quickly and at the minimum expense, consists mainly of the following:— Boiler Door Arches, designed with few joints and the proper flare; Large Blocks, tongued and grooved, for lining the fire-box. A patent Back Arch that is both simple and durable. Water tube as well as Horizontal boilers are fitted with our goods. Write for our booklet.

NEW YORK CITY BRANCH,
1402 BROADWAY

**McLEOD & HENRY CO.**

MAIN OFFICE & WORKS
TROY, N.Y.

The advertiser would like to know where you saw his advertisement—tell him.



"Vilter" double-acting Refrigerating Machine

Established 1867

The VILTER MFG. CO.

242 Becker St. Milwaukee, Wis.

BUILDERS OF HIGH-GRADE

CORLISS ENGINES

ICE AND REFRIGERATING MACHINERY

any size and for any purpose, complete line Ammonia Fittings, Condensers, Brine Coolers, etc.

Write for Catalogue and full Particulars

THE LINDE {AMMONIA / CARBONIC ACID} SYSTEMS

For Cold Storage and Ice-making Plants

SIMPLICITY, EFFICIENCY AND DURABILITY

Send for our catalogue showing details of installations and containing many useful tables and other data concerning this industry.

The Linde British Refrigeration Co., Limited, - Montreal

COMPLETE PLANTS DESIGNED AND INSTALLED

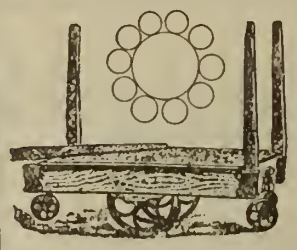
Switch Board Parts

Bulletin 3A—Just Out.

SEND FOR COPY.

The Hill Electric Switch & Mfg. Co., Ltd.

1560 St. Lawrence Street - Montreal



Roller Bearing Factory Trucks

The only ones made in Canada

Dry Kilns Installed

Roller Bearing Dry Kiln Trucks

Roller Bearing Transfer Trucks

Roller Bearing Lumber Trucks

MUNICIPAL STEEL BRIDGES Specifications Solicited.

We make any kind of truck to specifications. Heavy duty truck a specialty. Write for prices to

Corbet Foundry & Machine Co., Owen Sound

If you have Joint Troubles,

If you have New Pipe Lines to erect,

If you have Superheat, Moisture, Oil, Gas, Water or Acid to care for,

In a word, if you have Pipes (screwed or flanged),

Cylinders, Receivers, Economisers, Heaters, Radiators, etc., in use, you require

HAWKINS' IMPERISHABLE JOINTING CEMENT

Send for Booklet and Prices.

BAIN & MITCHELL, Y.M.C.A. Building, MONTREAL

Sole Canadian Agents for

W. T. HAWKINS & CO., HUDDERSFIELD, ENG.


## NOTICE TO STATIONARY ENGINEERS

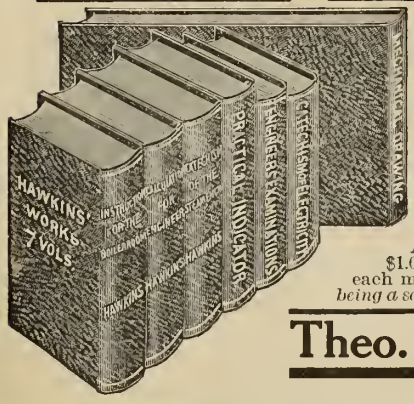
Every Certificate holder who intends to renew his Certificate should register with the Board not later than the First day of December, 1909, on a form which will be supplied. Any one who has not registered by the First of February, 1910, will not be granted a renewal only on the payment of the fee of Five Dollars.

I would also request those who have changed their address since receiving their certificate for 1909, and have not notified the Board, to do so at once.

W. C. McGHIE,
Chairman,
Parliament Buildings, Toronto

The advertiser would like to know where you saw his advertisement—tell him.

# HAWKINS' ENGINEERS LIBRARY.




Every Engineer, Superintendent, Machinist, Electrician or Power User should have the well known "Hawkins' Works" for study and ready reference. The seven books shown in illustration are the most complete and helpful works published for the practical man, convenient in size, and well bound, containing 2,208 pages, 5,171 ready references on engineering practice, 1,188 questions and answers, 444 standard rules, 1,258 illustrations and diagrams, making them a mine of the best and most reliable information obtainable. Sold on very easy payments as shown below.

SPECIAL OFFER Cut out and sign coupon, mark books desired (X). Any or all will be sent express paid upon receipt of $1.00 with order and agreement to remit balance $1.00 each month *(when complete set is purchased the price is $12, being a saving of One Dollar)*. **Hawkins' Circular free on request.**

**Theo. Audel & Co.** 63 FIFTH AVE., NEW YORK.

CUT OUT THIS COUPON

**THEO. AUDEL & CO., 63 Fifth Ave., New York**

Please send me the books marked (X). I encloso $1.00 to cover first payment and hereby agree to remit $1.00 each month until paid.

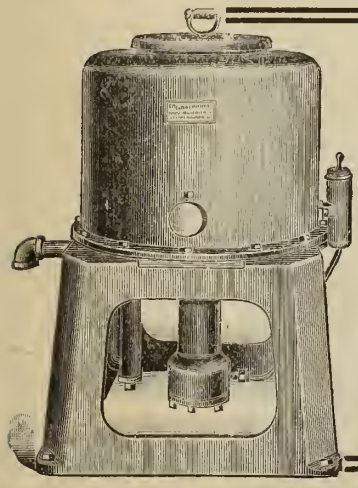
| (X) HERE | | |
|---|---|---|
| | HAWKINS' MECHANICAL DRAWING | 2 |
| | " ELECTRICITY (for Engineers) | 2 |
| | " ENGINEERS' EXAMINATIONS | 2 |
| | " STEAM BOILER PRACTICE | 2 |
| | " CALCULATIONS FOR ENGINEERS | 2 |
| | " STEAM ENGINE PRACTICE | 2 |
| | " STEAM ENGINE INDICATOR | 1 |
| | " CATALOG (free). | |

Signature .....

Occupation .....

Where Employed ..... (*Firm Name*)

Home Address .....



# Save the Oil—Don't Waste Waste

You simply have to place the dirty waste in this machine, turn on the steam and in half an hour the waste is perfectly clean and the oil—90% of it—is ready for use again.

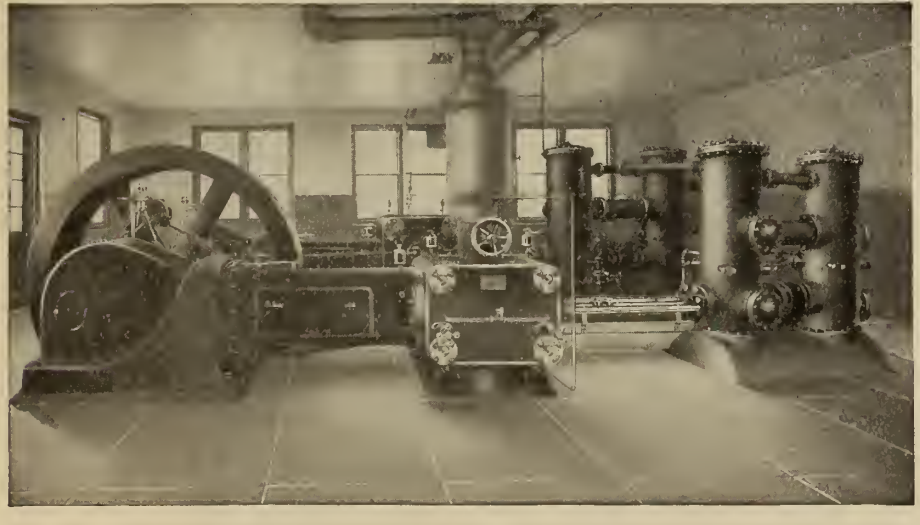
We have machines with—The E. B. Eddy Co., Ltd.; Grand Trunk Ry.; Canadian Pacific Ry.; Dominion Coal Co.; J. R. Booth; Toronto Water Works; T. Eaton Co.; Montreal Street Ry.; Nova Scotia Steel & Coal Co.; Toronto Railway; Algoma Steel Co.; Quaker Oats Co.; B. Greening Wire Co.; Imperial Oil Co.; Canadian Copper Co; Sarnia Electric Light Co.; Robt. Mitchell Co.; Montreal Rolling Mills; Canada Screw Co.; Crow's Nest Pass Coal Co.; Dominion Iron & Steel Co.; Temiskaming & Northern Ontario Railway Co.; Consolidated Mining & Smelting Co.; Montreal Cotton Co.; Frost & Wood Co., Ltd., and many others.

ASK FOR ATALOGUE

**The Canadian Oil and Waste Saving Machine Co.** Limited

BROCKVILLE, ONTARIO

# ROBB POWER PLANTS



# ENGINES

Corliss, Slide Valve, Horizontal, Vertical

# BOILERS

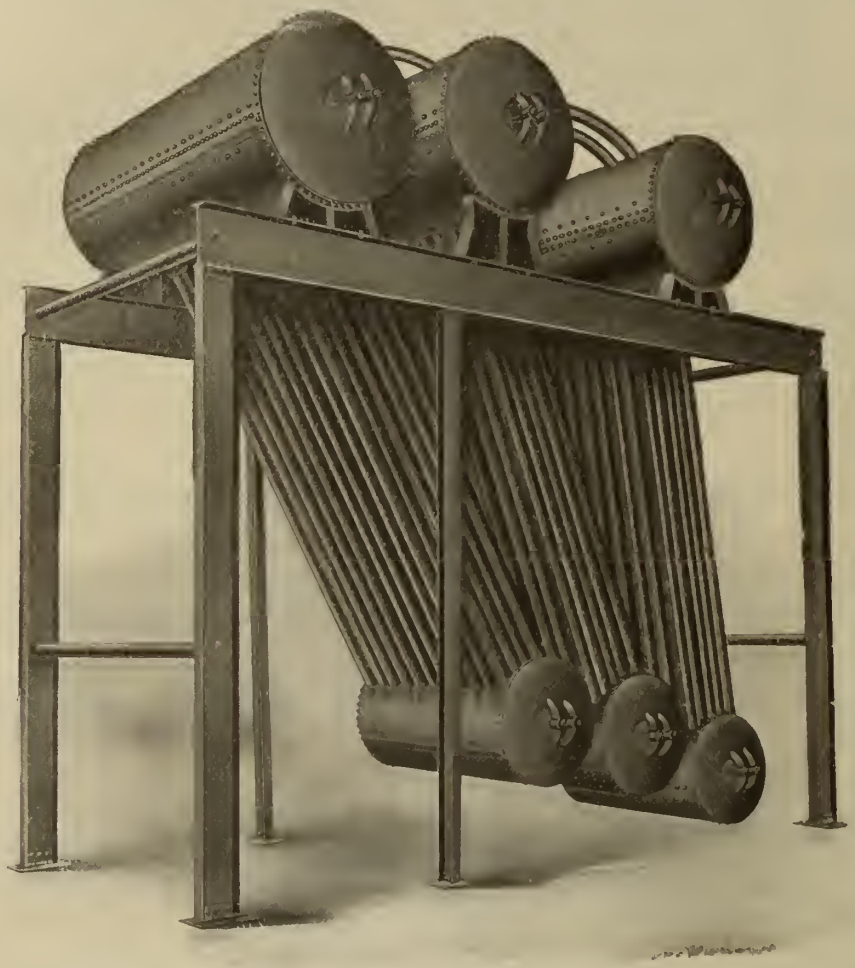
Return Tubular, Water Tube, Internally Fired, Portable

**Robb Engineering Co., Limited, Amherst, N.S.**

DISTRICT OFFICES
- 607 Canadian Express Building, MONTREAL; R. W. Robb, Manager.
- Traders Bank Building, TORONTO; Wm. McKay, Manager.
- Union Bank Building, WINNIPEG; W. F. Porter, Manager
- Calgary Block, CALGARY; J. F. Porter, Manager.

# Water Tube Boilers

## Return Tubular, Horizontal Marine, Vertical and Portable Boilers, with or without Wheels



Side View of our NEW WATER TUBE BOILER. Not bricked in.

## Our Engines, Boilers, Heaters, Pumps and Condensers are Prominent in Canada's Largest Power Houses.

## The Goldie & McCulloch Co., Ltd.

### Galt, Ontario, Canada

WESTERN BRANCH
248 McDermott Ave., Winnipeg, Man.

QUEBEC AGENTS
Ross & Greig, Montreal, Que.

BRITISH COLUMBIA AGENTS
Robt. Hamilton & Co., Vancouver, B.C.

**WE MAKE** Wheelock Engines, Corliss Engines, Ideal Engines, Piston Valve Saw Mill Engines, Gas Engines and Producers, Boilers, Heaters, Steam and Power Pumps, Condensers, Flour Mill Machinery, Oatmeal Mill Machinery, Wood-Working Machinery, Transmission and Elevating Machinery, Safes, Vaults and Vault Doors.

Ask for Catalogues, Prices and All Information.

# Plant and Equipment of Cobalt Hydraulic Company

Perhaps the largest undertaking of the three power companies, near Cobalt, is the plant of the Cobalt Hydraulic Power Co., which will generate air from Ragged Chutes on the Montreal River, 8 miles from the camp. The plant is practically automatic as the air compression is effected on the Taylor system by the direct action of falling water.

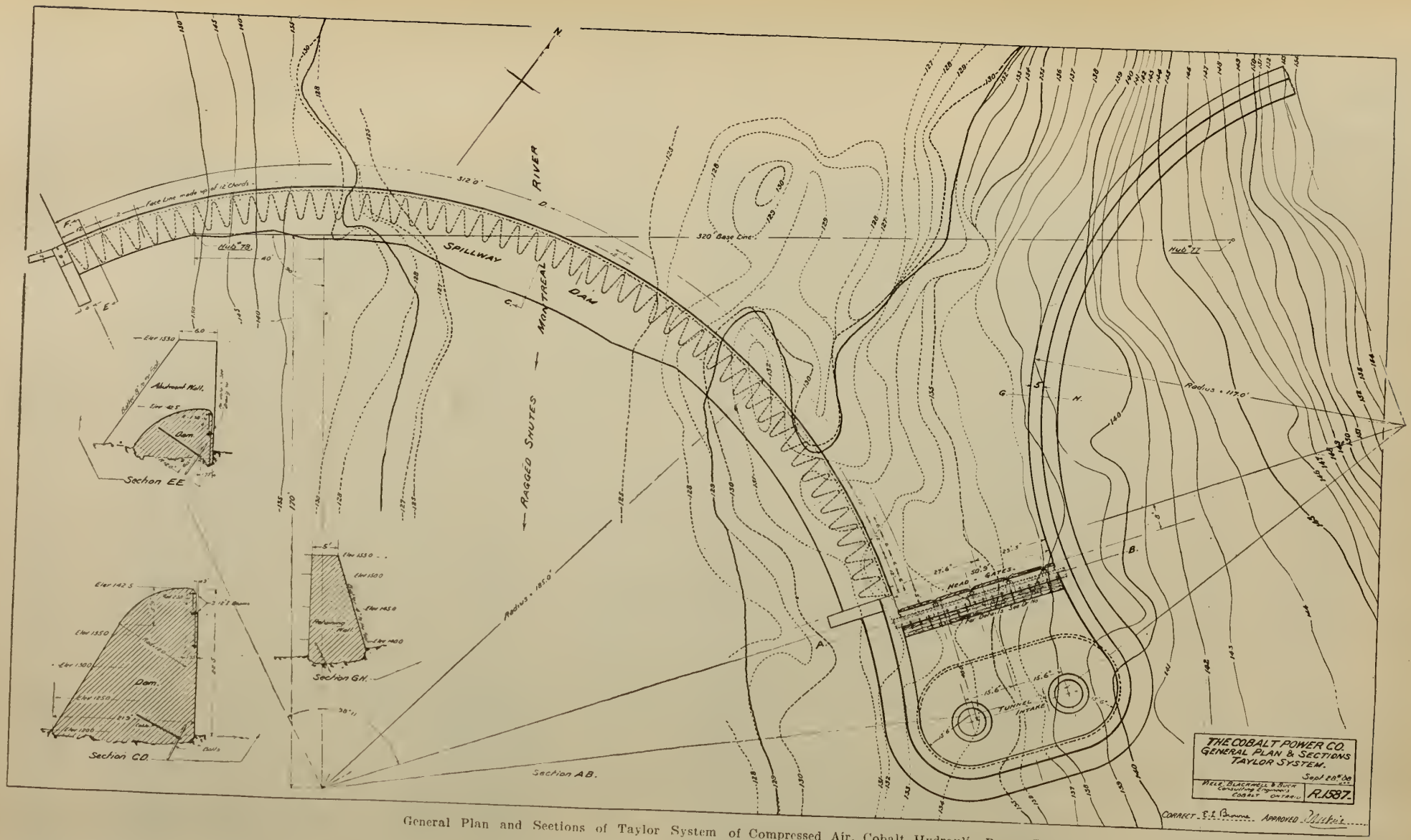
Although the principle involved in the Ragged Chutes installation has been utilized for many centuries, it is only with the last few years that successful commercial applications of this principle have been made on a large scale. Modern plants, such as that built in 1900 at Ainsworth, B.C., by the Kootenay Air Supply Co., are all based upon the system elaborated by Charles H. Taylor, of Montreal, who, in 1896, devised the equipment of the Dominion Cotton Mills, at Magog, Quebec.

Spillway of Dam, Ragged Chutes.—Cobalt Hydraulic Power Co.

Mr. Taylor's modification simply consisted in an effective method of breaking up the water and impregnating it with finely divided particles of air.

Cobalt Hydraulic Power Co.

Perhaps one of the greatest feats of engineering ever achieved in the Cobalt camp, or perhaps in Canada, in the




General Plan and Sections of Taylor System of Compressed Air, Cobalt Hydraulic Power Co.

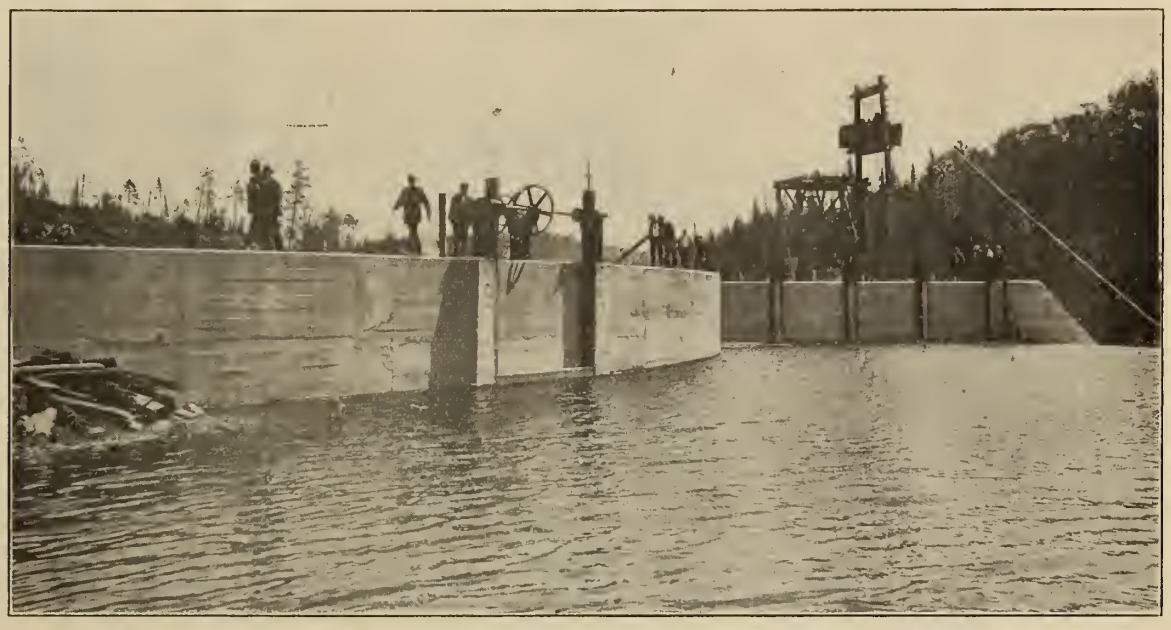
past year, was the one effected in the construction of the Cobalt Hydraulic Power Company's plant, when the engineer connected up a 1,000 foot tunnel at a depth of over 300 ft. under ground and in driving from both ends, was only one-tenth of a foot out of alignment and grade. To drive that distance at that depth with only one and a quarter inches out of alignment and grade, is considered to be one of the greatest feats of the camp, and speaks well for the engineer in charge of the work.

The Ragged Chutes plant is probably the largest natural compressor in the world. A 660-foot dam stretches across the Montreal River at Ragged Chutes. Here, at the intake gates, are two 16-foot intake pipes, to each of which is fitted 66 air-intake pipes 14 inches in diameter. These heads are maintained at a height which slightly submerges the tops of the smaller intake pipes by means of vertical pneumatic lifts operated by compressed air piped from the air mains. The falling water draws air in through the small pipes, and thus in its descent of 351 feet becomes a mixture of water and compressed air. The water intake pipes are reduced to a diameter of 9 feet immediately below the spider.

Forty feet from the bottom of the shaft the diameter is increased to 11½ feet. This increase of diameter tends to lessen the velocity and to liberate the air. Two steel-sheathed concrete cones receive the full impact of the water and direct it into a horizontal tunnel 1,021 feet ling, following the flow of the river. The tunnel is 22 feet wide and near the bottom of the tail-shaft 42 feet high. At the bottom of the intake it is 26½ feet high. Sections AA and BB in Fig. 1 show the difference in height. Diverted into this commodious channel, the water loses momentum, and the air is freed rapidly. It is at this point under a compression of 125 lb. per cubic foot. At this pressure it loses all but a negligible amount of its vent. The water itself enters the tail-shaft, and, since there is a drop of 48 feet between the intake and the mouth of the tail-shaft it overflows into the river.

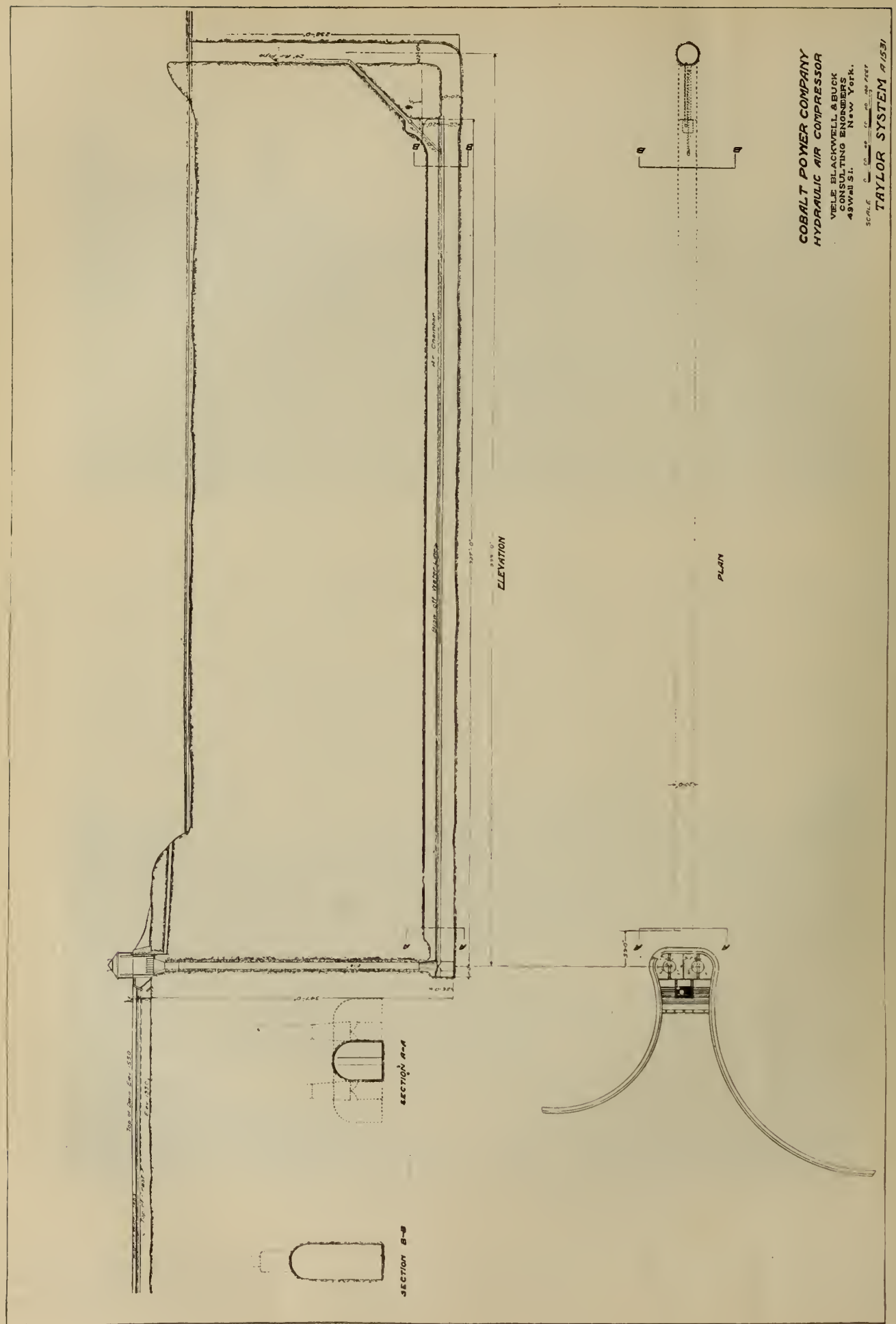
The 20-inch main is constructed of steel pipes brought from Germany. It is made up of 40-foot lengths of seamless flanged steel, each length weighing 3,000 lbs.

To guard against the evil effects of unequal temperatures, the pipe-line is anchored to heavy concrete piers on solid rock foundation at half-mile intervals. Halfway between each pier an expansion point is fitted in the system. Elaborate care has been taken with gaskets and with joints to insure absolute air-tightness. Every joint is supported by two rails which, in turn, are



Intake Gates and Part of the Dam—Cobalt Hydraulic Power Co.

Part of General View—Cobalt Hydraulic Power Co.




Elevation of Tunnel, etc., Cobalt Hydraulic Power Co., Cobalt.

bolted to wooden ties buried beyond danger of damage by fire or weather.

This 20-inch pipe line ends at the La Rose mine, where smaller 12 inch pipes run in various directions. One circles around by the Trethewey, Coniagas, Buffalo, McKinley-Darragh and Nipissing and then joins with the main line just north of the Gillies Limit. Another pipe line runs out to the Nova Scotia mine, touching all the intervening properties.

It has been decided by the management to run 8,000 feet of a six inch pipe west through the Gillies Limit and ending at the Red Jacket mine. This, with the mile between the Nova Scotia and the Kerr Lake is the only part of their surface work that remains unfinished.

In the tunnel the air is at 125 lbs. pressure. To the larger consumers, air will be supplied by meter, the terms of which will be 25 cents per thousand cubic feet of compressed air at 100 lbs. pressure. To the small consumers, who will pay for pipe connection from premises to main pipes, the following rates will be charged, per drill per 10-hour shift : 1 drill, $5; 2 drills, $4; 3 drills, $3.50; 4 drills, $3.13; 5 drills, $2.80; thus varying from $5 per shift per drill to $2.80 per shift per drill for five drills or more.

This air from Ragged Chutes is perfectly dry and free from moisture so that in the summer the underground working will not be heated, nor in the winter subject to freezing.

---

### LARGEST GAS ENGINE IN CANADA.

I notice on page 21 of the September issue of The Power House, a description of what is called the largest gas engine installed in Canada. This is an error, as the writer installed in Edmonton, Alberta, a 1,000 horse power twin tandem Allis-Chalmers producer gas engine, burning successfully lignite fuel, having cylinders one-inch larger than the Moncton engine, that is, 24", and 3" longer, that is, 36" stroke. This engine is working successfully, and is more than twice the size of the Moncton one. Credit is due to Alberta and to myself, for the largest instalation at the present time, in the Dominion. R. P. Keely, professor of electrical engineering, Department of Technical Education, Halifax.

---

Geo. M. Hoffman, sole proprietor and manufacturer of U. S. Metal Polish, Barkeeper's Friend and other specialties, died at Indianapolis, Ind., Oct. 22. The business will be continued under the management of Mrs. Hoffman.

# What is Real Meaning of the Term Efficiency?*

Efficiency as Applied to Air Compressors and Refrigerating Machinery, etc., Showing the Methods for Determining of Efficiency.

By Peter Neff.

The past few years have shown a wonderful awakening of interest in the consideration of refrigerating apparatus, but there has been manifested a certain recklessness in the use of the terms to imply certain relationships, and no one word has been made to cover a wider range than the term "efficiency."

No doubt many in using the term have had clearly in mind the relationship intended and yet have failed to qualify it so as to make the relationship clear to others. Again others seem to have no idea of the meaning, or at least a very distorted one. As an example of the latter, a salesman made out a contract proposal and specified his machine as 98 per cent. efficient. Another salesman, seeing this, promptly put his machine at 100 p.c., and when asked what he meant, said his machine would do the work, therefore was 100 per cent. efficient.

Here are two expressions used by the same party to represent precisely the same ratio, "Actual Volumetric Efficiency," "Actual Efficiency." The first would appear to mean something definite, while the latter appears like advertising. Again he uses simply "Volumetric Efficiency" for a different relationship from the foregoing. One states that "Volumetric Efficiency" is the ratio of the actual volume of vapor drawn from the suction pipe to the compressor displacement for the same time," while another defines it simply "as the percentage of displacement."

During a recent test the professor in charge was asked to indicate in his report the "Volumetric Efficiency." He was furnished with all data available relating to the use of this term by others. In his report he stated as follows :

"An attempt was made to present the volumetric efficiency under definite names, but a brief study of this subject reveals the fact that there seems to be no definite agreement as to the name which shall be used to specify any given volumetric efficiency. What one calls '"mechanical volumetric efficiency"' another calls real. There seems to be considerable confusion in the use of the terms real, mechanical, theoretical, apparent, etc."

He gave four distinct ratios for volumetric efficiency of the apparatus in question and these varied from approximately 75 to 90.

Dr. Siebel in the Compend says :

"The term efficiency has a variety of meanings, and the one specifically intended should be expressed clearly in each case. Generally efficiency is expressed by the number of units of heat removed from the refrigerating coils or refrigerator for every thermal unit of work done by the compressor. * * * This may be called "actual" efficiency, as it varies not only with the machine but also and most positively so with the local conditions under which it works. * * It offers no criterion as to the lost work done by the compressor, i.e., it is not an expression for the degree of perfection in the compressor.

In order to obtain a comparison for this quality, we must, according to Linde, compare the actual efficiency of the plant with the maximum theoretical efficiency of the plant when working under the same conditions."

Another states : "The expression for efficiency as a compressor may be written thus :

$$\text{Efficiency} = \frac{\text{Initial Quantity of Heat}}{\text{work performed.}}$$

He then states in explanation of this expression "that the efficiency of a refrigerating apparatus is increased when the initial temperature is raised, etc." Here he uses the term "apparatus" manifestly a broader term than compressor, and might mean the whole machine, including its motive power.

Another states : "In a refrigerating plant high efficiency means passing the maximum weight of gas through the cylinder of the compressor with a given expenditure of power."

Further on the same party states : "There is the efficiency of the compressors as a complete machine, or the ratio which the indicated horse power of the steam cylinder and the compressor bear to one another."

Another in speaking of the efficiency in a compressor states the following : "The principal qualities to be sought for in a compressor in order to insure the maximum amount of efficiency, are as complete a discharge from the compressor cylinder of the gas during the compression as is practically feasible, and the removal during the compression of the greatest possible amount of heat from the gas."

Still another gives the following general expression for the efficiency of a

---

* Abstract of a paper read before the American Society of Refrigerating Engineers.

refrigerating machine: "Energy obtained divided by energy expended."

Examples could be multiplied to show the variation of language regarding efficiency.

A good deal has been said in a recent discussion as to the value of indicator cards in determining the efficiency, and just here I want to say a word in regard to the value of indicator cards in determining anything in regard to the compressor.

It is true that the mere appearance of the card tells nothing, and until you have laid in the adiabatic and isothermal lines, you are not in a position to interpret the card correctly. But I want to add that the indicator card that does not have traced upon it, while on the indicator, the line of suction can not ordinarily be interpreted correctly.

My attention was particularly called to this in connection with a large amount of indicating which was being done at one time and on which several standard and supposedly correct indicators were used. The results from these indicator cards varied. A connection was made to the indicator cock so that immediately upon closing off from the compressor this connection could be opened and the pressure in the suction pipe just before it entered the compressor brought under the piston of the indicator.

The result was rather surprising. The filling line of that card showed above the suction pressure line, manifestly an impossible condition. This did not occur with one indicator, but with several, and with certain makes of indicators it was impossible to get a true reading. In other words, suppose the compressor was not filling to suction pressure, this error of the indicator, if scaled up, made it appear that the compressor was filling. To indicate the compressor properly requires a first-class indicator and this must be in first-class condition, and I would not give any value to an indicator card that did not show this suction pressure line.

The use of thermometers on both suction and discharge of the compressor is a necessity in the study of compressor performance.

In steam engine practice several efficiencies are recognized. In discussions in regard to engines, the efficiency is usually specified so that it is self-explanatory.

In speaking of engine performance, it is stated: "In the early days of engine testing, it was usual to express the performance of the engine in terms of the number of pounds of coal used per indicated horse power per hour, which was all right if the performance of the whole plant was desired, but as a scientific measure of the performance of the engine itself, it was valueless because it included also the performance of the boilers."

A committee of the Institution of Civil Engineers considered this question and issued a report of which the following are some of the recommendations:

1. That thermal efficiency as applied to any heat engine should mean the ratio between the heat utilized as work on the piston by that engine and the heat supplied to it.

2. That the heat utilized be obtained by measuring the indicator diagrams in the usual way.

They then go on to show what degree of temperature of the steam, both live and exhaust, should be taken and gave the standard method adopted, and continue:

That the ratio between the thermal efficiency of an actual engine and the thermal efficiency of the corresponding standard steam engine of comparison be called the "Efficiency ratio."

It is probable that in future steam-engine performance will be expressed in terms of thermal units per minute per I.h.p.

The theory of efficiency of ideal engines, applying steam or other vapor as the working fluid, is simple and exact, but the results obtained in this case differ usually very widely from those practically reached in the real engine of which it is the representative.

The author then goes on to show that there is "an efficiency of the machine," of "steam of machine," of "engine friction," of "engine and jacket," etc.; that "heat engines of whatever class, type or form, simply convert thermal energy into useful dynamic energy, and their efficiency is therefore measured by the ratio of the amount of energy thus rendered available to the quantity of the energy originally supplied for transformation," and compressors simply reverse this order.

Then there is the efficiency of the compressor and combined motive power. You can have a good compressor and a poor engine, or a compressor not so good and a better engine, and the combined results, or the value the purchaser is buying, may be greater in the latter case than in the former. The sooner this society gets down to some basis which will make it plain what is meant by efficiency of refrigerating apparatus, and define the several different efficiencies, the better for all.

There are so many able refrigerating engineers working continually on this subject, that it would take but a short time for them to agree on certain efficiencies and give them their proper name, and thus render to the trade in general and to the refrigerating engineers as a class assistance which those of us who are called upon continually to figure, would find a great boon.

## THE COST OF POWER.

In a paper read before the American Institute of Electrical Engineers, H. G. Scott gives the following relative costs per kilowatt-hour for different kinds of power plants having a maximum load of over 30,000 k.w. This table gives the distribution of maintenance and operation.

For steam turbine plants larger than 60,000 kw., the cost per kilowatt may be reduced to $75.

| | | Reciprocating Steam Plant. | Steam Turbine Plant | Reciprocating Engines and Low-Pressure Steam Turbines. | Gas Engine Plant. | Gas Engines and Steam Turbines. | Hydraulic. |
|---|---|---|---|---|---|---|---|
| | Maintenance. | | | | | | |
| 1 | Engine room, mechanical | 2.59 | 0.51 | 1.55 | 5.18 | 2.84 | 0.51 |
| 2 | Boiler or producer room | 4.65 | 4.33 | 3.55 | 1.16 | 1.97 | |
| 3 | Coal and ash-handling apparatus | 0.58 | 0.54 | 0.44 | 0.29 | 0.29 | |
| 4 | Electrical apparatus | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 | 1.13 |
| | Operation. | | | | | | |
| 5 | Coal | 61.70 | 55.53 | 52.44 | 26.52 | 25.97 | |
| 6 | Water | 7.20 | 0.65 | 0.61 | 3.60 | 2.16 | |
| 7 | Engine room, labor | 6.75 | 1.36 | 4.06 | 6.76 | 4.00 | 1.30 |
| 8 | Boiler or producer room labor | 7.20 | 6.74 | 5.50 | 1.81 | 3.05 | |
| 9 | Coal and ash-handling labor | 2.28 | 2.13 | 1.75 | 1.14 | 1.14 | |
| 10 | Ash removal | 1.07 | 0.95 | 0.81 | 0.54 | 0.54 | |
| 11 | Electrical labor | 2.54 | 2.54 | 2.54 | 2.54 | 2.54 | 2.54 |
| 12 | Engine room lubrication | 1.78 | 0.35 | 1.02 | 1.80 | 1.07 | 0.20 |
| 13 | Engine room waste, etc. | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.20 |
| 14 | Boiler room lubrication | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | |
| | Relative operating cost per cent. | 100.00 | 77.23 | 75.87 | 52.94 | 47.23 | 5.94 |
| | Relative investment per cent. | 100.00 | 75.00 | 80.00 | 110.00 | 96.20 | 100.00 |
| | Probable average cost per kilowatt | 125.00 | 93.75 | 100.00 | 137.50 | 120.00 | 125.00 |
| | Probable fixed charges per cent. | 11 | 11 | 11 | 12 | 11.5 | 11 |

# Why Refrigerating Plant Fails to Make Capacity

Many explanations are given for the causes of decomposed ammonia. The following article gives a remedy for purging the system of foul and permanent gases whose presence is supposed to be due to the quality of present day ammonia.

I believe my experience, which stretches over a good many years, warrants me in saying that ammonia to-day is superior to the ammonia of the past, says a writer in "Ice." It does not stand to reason that in the advance of the chemical industry in recent years ammonia should be the one line to fall behind. Tons are made to-day where pounds were made twenty years ago. Some of the manufacturers make broad claims for their product just as is done in all other lines, but I fail to see the justice of making ammonia the scapegoat for poor engineering skill or practice.

It is my observation that the fault is not with the ammonia, no matter what the brand. It is all reliable enough, for the fact remains that they all give good results when the conditions are what they should be and poor results when operating conditions are bad. The right conditions include the skill of the engineer, the temperature and quantity of the condensing water, ammonia and brine at the proper strength and the necessary machinery and appliances kept in the best of order. When these are all right everything is right, but default in one means decreased output before long.

First of all the engineer must be a real engineer and not an incompetent one; he must understand his business and attend to it. With an incompetent man no matter how good the conditions, the owner will get poor results and be offered a hundred theories to explain why it all happened. Theory is all right in its place and there is a world of it necessary in this particular line of engineering, but there is nothing in the books like the incompetent engineer will offer in explaining why he fails to produce results; the machine is wrong, the ammonia is no good, everything is wrong but himself, when in reality the trouble is all under his hat between hair and neck.

Isn't this about the way things usually are in the spring? The condensing water is cool, the pumps are in good order, the coils in the absorber are clean, the gas and poor liquor coils are in good shape and the gas is being liquefied in such easy fashion that the expansion valve is barely touched and the temperature of the brine goes down, and the pressure on the absorber is from 3 to 10 pounds.

As the days grow warmer and longer the temperature of the condensing water rises rapidly, the condenser pipes and absorber coils get fouler, the brine gets higher, the pressure on the absorber rises, the output falls off, and the engineer begins manipulating the expansion valve, usually opening it wider. Then follows the cycle. The absorber pressure increases with the result that the pump does not handle the requisite amount and you do not make enough gas. What gas is made is rushed through the expansion valve before it is liquefied and the absorber continues to grow warmer, the pressure is increasing and the pump begins to act queerly. Then the engineer reaches the conclusion that the machine is gas-bound and the ammonia has decomposed.

Adding ammonia to the charge in the system helps some temporarily. As I said before the engineer is responsible for the conditions that exist; fouling of tubes and coils is due to his failure to clean them at intervals, the pump is out of whack because he has not looked after it properly, the expansion valve has been manipulated too freely because he does not know the proper place to set it.

I am not intimating that the expansion valve should be a fixture in the same position under all conditions, but deprecating the efforts of some unskilled or careless engineers to make it control a system that has been allowed to get in bad order. The operation of the expansion valve requires knowledge and skill. When the coils and tubes get foul clean them with whatever means you have at hand. Steam and water are the best I know. When things are clean again start the machine and you will find that absorption will take place in the absorber where it belongs, not in the generator. The decomposition you thought you had will vanish until the system gets foul again when the permanent gases will show up again, but as for real decomposition it will not and does not occur.

There is not heat enough in the steam to decompose ammonia as is well known by all manufacturers of this product and by all men whose work has been concerned with handling it for any length of time. Fifty per cent. or more of the failure of refrigerating machines to make capacity is due to poor management. The best machine ever built can not give results when handled by a man who does not know his business. Sometimes a man who knows his business will not attend to it, and his case is worse than that of the ignorant one.

I thoroughly believe that steel pipe as offered the trade to-day is neither safe nor reliable enough for ammonia work. It is far inferior to old style wrought iron pipe, so far, in fact, that there is no comparison. The fittings of the day also speak for themselves. All you have to do to get an idea of the quality of fittings now on the market for ammonia work is to visit any plant and see the ammonia oozing from them right under the eye of the engineer, but he can not help it. A large percentage of them are unfit for ammonia work and I have replaced an old with a new many times only to find that the new was no better. If such conditions exist right under your eye what must be going on in the out of the way places.

In poor engineering skill, careless methods, sorry pipe and fittings lie the reasons for failure to make capacity and large ammonia and repair bills. The engineer can not always stop the losses due to fittings and the like, but a clean system will obviate the necessity of so frequent use of the purge valve under the guise of "decomposition," and this will help the expense account. Above all I urge engineers in ice-making plants to study their work and get all the information possible. The industry is growing and there is a big demand for skilled men, but this line is no place for the careless and ignorant.

## METHOD OF CALCULATING HORSE POWER.

By Dennis Stovall.

The problem of calculating the horse power of a waterfall or running stream is reduced to a simple formula. It is based on the assumption that a horse power is equal to 33,000 pounds lifted one foot per minute. This is the basis used in computing horse power in any type of power developing machine.

On this basis, the horse power of a waterfall or stream is found by multiplying together the number of cubic feet of water which fall per minute, the vertical height or "head" in feet through which it falls, and the number, 62.3, this being the weight of a cubic foot of water in pounds; then divide the product of the whole by 33,000. Reduced to a formula, the problem appears as follows:—

$$\text{h.p.} = \frac{\text{Cu. ft. p.m.} \times \text{vert. ht. ft.} \times 62.3 \text{ lbs.}}{\text{33,000-ft. pounds.}}$$

To better explain this formula, let an average case be supposed: Over a fall 20 feet high 1,000 cubic feet of water is discharged per minute. This problem would take the following simple form:—

$$\frac{1{,}000 \text{ cu. ft.} \times 20 \text{ ft.} \times 62.3}{33{,}000\text{-ft. pounds}} = \frac{124{,}600}{33{,}000}$$

= 40.71 horse power.

To use this formula the amount of discharges of the waterfall in cu. ft. p.m. must be known. This, however, is not difficult to ascertain. By careful observations the cross-section area of the fall is learned and computed; this is then multiplied by the rate of velocity of the fall in feet per minute. This will give the number of cubic feet of water discharged per minute. The results are only approximate; but the main idea is to be as accurate as possible in making observations and securing data. It should be remembered that the formula itself is right; if errors occur, it must either be in the observations or in the final calculations.

The power of the waterfall will be developed by a breast-wheel, overshot, turbine or other type. But whatever the type, there must necessarily be considerable loss. Even though the observations are carefully taken and the horse power has been carefully calculated by the above rule, allowance must be made for loss in the selecting of the wheels. Thus, an undershot realizes only one-fourth or, at best, one-third the actual power of the fall; a breast-wheel realizes one-half; an overshot wheel from two-thirds to three-fourths; a turbine from 0.75 to 0.87, and even as high as 0.90 of the fall, depending upon the skill of workmanship in manufacture and the manner in which it is installed. While an undershot or breastwheel costs less to place, unless there is "water to throw away," it is far cheaper in the long run to place a good overshot wheel or a turbine.

To make calculations of the power capable of being developed by a running stream, it is presumed that the stream is confined at its point of proposed use to a flume of known dimensions. As the stream must be so confined before the water-wheel is placed, the estimates or figures for such conclusions will not be difficult to secure. About the only type of wheel that can be used in developing the power of a running stream is that with simple float-boards, instead of buckets or flanges. Thus, the wheel is driven by the ordinary or natural current of the stream without any appreciable fall like that in the preceding case. To apply the formula already given in calculating the water power of a running stream, the virtual head, or rate of flow of the current should first be learned. This is done by using floats, and by taking a number of observations between given points, "time" the speed of the floats and learn the velocity of the stream in f. p. m. Having thus found the head, the miner must next find the quantity of water which passes any given area of the stream in a minute. Thus, to use an average case, let it be supposed that the velocity or rate of flow of the stream is 250 feet per minute, and that the immersed part of the water-wheel float is 6 feet long and 1 foot wide or deep; then the area of the part of the wheel, which receives the force of the current in 6 by 1, or 6 sq. ft. Hence, the formula for finding the cu. ft. p. m. would be in this case:—

6 sq. ft. $\times$ 250 ft. p. m. = 1,500 cu. ft. p. m.

The vertical height, or head of a running stream would virtually be the "grade" of the stream for a 10-foot section, or merely that portion used where the wheel is installed. In average cases this would amount to 0.19 or 0.2. Thus with the cubic feet of discharge per minute ascertained, and the head known, the horse power is found by the formula given above for waterfalls. to use the case just cited, the results would be as follows:—

$$\frac{\text{1,500 cu. ft. p.m. x 0.19 vert. ht. in ft. x 62.3 lbs.}}{\text{33,000 ft. pounds.}}$$

=0.50 horse power.

In a running stream, as in a waterfall, there is considerable loss when the utilization of its power be attempted. As but one type of wheel can be used, it is estimated that this loss in running streams is 0.6; that is, the wheel actually realizes only 0.4 the actual power of the stream. Hence, in the case just given the power developed would only be 0.54 by 0.4, or 0.216 horse power. Multiplying this by 33,000 foot-pounds, it will be found that the wheel would be capable of lifting 7,128 foot-pounds per minute. But a rough allowance would still have to be made for friction of the journals, cutting the actual power of the wheel down to 7,000 foot-pounds per minute, which would be very close to what such a wheel, driven by a current of this velocity, head and size would develop.

In measuring the velocity of a running stream, calculation should not be made upon the surface speed of the current. The usual method, and that most likely to give average results, is to use a float which is submerged to a depth of one-half the width or depth of the wheel paddle; that is, if the paddle of the wheel dips into the water one foot, the float for estimating the velocity of the current should be submerged six inches.—Mining World.

---

Evidently carbon filament lamps are still receiving considerable attention in England. Two patents have recently been issued on the subject, one aiming to regenerate the filament, and the other to prevent the blackening of the glass bulb. In the first the bulb is opened, and after being cleaned hydrocarbon is introduced. Then on heating the lamp the hydrocarbon is decomposed and the carbon is deposited on the filament. In the second case the inventor believes that the blackening of the glass may be obviated by removing the mercury vapor which enters therein while the bulb is being evacuated. Therefore he proposes to coat the stem which holds the filament with silver, so as to absorb the mercury vapor.

A recent article in the Electrical World contains the following data relative to the utilization of the energy from Niagara Falls. Of the 5,000,000 horse-power represented by Niagara Falls, only about 5.5 per cent. is being utilized. Of this, 126,800 horse-power is employed in electro-chemical processes, 56,200 horse-power for railway service, 36,400 horse-power for lighting, 45,540 horse-power for various industrial services; 12,300 horse-power is transmitted over more than one hundred miles, 33,500 horse-power between seventy-five miles and one hundred miles, 3,100 horse-power fifty miles, 79,640 horse-power between ten and thirty miles, while 145,400 horse-power is used locally, showing that many industries have been attracted to Niagara Falls because of the favorable electric power conditions to be found there.

# Properties of a Good Lubricant and Tests for Same

## The Dearborn Drug and Chemical Works, Chicago, have Several Good Rules for Distinguishing Properties of Lubricants, Which are of Interest to Engineers.

Lubricants are divided into three general classes, viz., liquid, semi-solid, and solid.

To the liquid lubricants belong all lubricants which remain liquid at ordinary temperatures; mineral, animal, or vegetable, or mixtures of the same. It comprises all cylinder, dynamo and engine oils, etc.

### Semi-solid Lubricants.

Under the head of semi-solid lubricants may be included the many kinds of lubricants commonly known as greases, which are composed of mineral oils and other products of petroleum, and contain a sufficient quantity of soap, of some kind, to give them the desired thickness or hardness. Frequently, paraffin, or other wax, is depended upon to give the desired hardness. The soaps most commonly used for this purpose are lime soap, soda (ordinary) soap, lead, and zinc soaps. The so-called thickened or solidated oils contain some of these, or in some cases, aluminum soap.

### Solid Lubricants.

Solid lubricants are substances which, when submitted to sufficient pressure, may bo welded into a more or less solid mass, but, when submitted to even small resistance, or to the movement of comparatively smooth surfaces, readily shear and distribute themselves over the surfaces of the rubbing parts. The most common solid lubricants are graphite, powdered mica and soapstone (silicate of magnesia). Their action is materially different from that of solid fats and greases, as the latter melt at comparatively low temperatures, while the former remain in an unaltered condition between the surfaces at any temperature common in practice.

### Steam Cylinder Lubrication.

In selecting an oil for steam cylinder and valve lubrication, it is vitally necessary to have a complete understanding of the conditions under which it is to be used. To obtain the best and most economic results, the properties of both lubricant and steam must be taken into consideration.

The steam pressure, or, better still, the internal temperature of the cylinder and the moisture contained in the steam are important factors. The higher the steam temperature the higher must be the flash and burning points of the oil, in order that undue evaporation shall not take place; as in such case the vapor is rapidly carried out with the exhaust steam, the quantity of oil on the interior surfaces rapidly reduced, and the lubrication more or less impaired, unless an excessive quantity of oil is constantly applied.

The viscosity of the oil must be such as to warrant its atomizing readily at the temperature of the steam, in order that it will reach all parts of the cylinder, as the piston and often the valves move to and fro in straight lines and do not tend to automatically trap the oil properly and keep the surfaces from touching. An oil of too high flash and burning points and viscosity will not give proper lubrication, any more than one where they are too low. In cases of comparatively high temperature in the cylinder, and practically dry steam, a pure mineral oil will usually give the desired results, but as the steam is more or less wet, it becomes necessary that some vegetable or animal oil or fat be added thereto to take care of said moisture. A pure mineral oil will not lubricate satisfactorily where there is much moisture, due to its inability to adhere sufficiently to the wet surfaces; while, on the contrary, some animal fats readi'y emulsify with the moisture and adhere to the surfaces. For this reason, it is essential that most steam cylinder oils contain a sufficient amount of an animal fat to overcome the effect of the moisture. As the animal fat is prone to become rancid (acid) under such conditions, it is imperative that none other than the very best obtainable acidless fat be used. A pure acidless tallow oil is one which is especially adapted to such use; in fact, nothing but the very best obtainable acidless tallow oil should be used. No greater percentage of tallow oil should be used than is necessary to accomplish the results desired; when present in excess it impairs lubrication rather than improves it. As in alloys of metals, to obtain a perfect product, it is necessary that the proportion of constituents used should be properly adjusted and thoroughly blended and mixed.

### Engine and Dynamo Lubrication.

In selecting an oil for this class of machines, greater attention should be paid to the viscosity than to any other property. The viscosity should be sufficiently high to assure the proper filming of the oil, in order that the rubbing surfaces will be kept apart at all times while in motion. The viscosity must not, however, be so great that the thinnest film possible for the oil to form will not permeate the slight space between the moving surfaces; on the whole, the slower the speed the greater should be the viscosity. Save in very exceptional cases, a pure mineral oil will give the best results.

Oils selected shou'd be absolutely free from grit, tarry matter and acids of any kind. They should be of comparatively light gravity,—have a flash point of not less than 400 degrees Fahrenheit, a burning point of not less than 440 degrees Fahrenheit, and a viscosity from 170 upwards, as the case demands. They should be strictly products of the best paraffin-base crude petroleums, distilled by the wet or steam process, properly refined (without the use of acids and alkalis), thoroughly deb'oomed, paraffin wax removed, and filtered through animal charcoal (bone black) or fuller's earth, to the desired color and perfect transparency.

Animal and vegetable oils or fats are objectionable in engine and dynamo oils (except for marine engines), as when exposed to dry atmospheric conditions in practice, they become so decomposed, or changed, as to become more or less gummy, in which condition they readily attract any dust or grit in the air and become very objectionable and of no lubricating value.

In cases where the fat becomes acid, the latter attacks the metal of the bearing, forming what is known as metal'ic soaps, which being soluble in the mineral oil, are taken up, the continuation of these conditions resulting in corrosion of the surfaces.

### Marine Engines.

In case of marine engine lubrication, it is necessary to use an oil compounded with lard oil in order that it shall readily emulsify with the large amount of water with which it comes in contact (as water is usually kept running on the bearings, and a pure mineral oil would very readily wash off). But with a proper pure mineral oil, compounded with twenty-five to thirty-five per cent. of best winter-strained lard oil, the desired emulsification is obtained, the mixture of oils and water adhering to the moving surfaces and giving satisfactory lubrication.

### Semi-Solid Lubricants—Grease.

Under this head are cup and other greases common to the trade and en-

gineering circles. In the manufacture of cup greases, nothing but the most perfectly refined mineral oils, acidless tallow or tallow oil, should be used, with the very least amount of soap which will afford a product of uniform composition; with as little paraffin as possible; and with a sufficient amount of beeswax to lend to the paraffin improved lubricating qualities. It is also essential that the soap used be made of materials of superior quality, so compounded as to obviate free alkali or free fatty acids, and to obtain a neutral product.

After all of the ingredients have been put together, and maintained at a proper temperature for a sufficient length of time, the mixture is allowed to cool, when it must be thoroughly milled (ground) to insure an extremely intimate and uniform mixture of the whole.

### Physical Properties of Lubricants.

Since the process of lubrication is a physical and not a chemical one, it is possible to judge the quality as well as the adaptability of a certain oil to use under certain conditions, by determining said physical properties, together with a few minor analytical determinations, such as the determination as to whether or not the oil is a pure mineral, or compounded one; and, if the latter, the amount and kind of animal or vegetable oils contained, together with an examination for acidity, the presence or residuum or tarry matter.

### Gravity and Density.

The gravity of a liquid or solid substance is the weight of the substance as compared with an equal volume of water at 60 degrees Fahrenheit. The gravity of lubricating oils being lighter than that of water, their specific gravity is less than one; for example, assuming that a pint of distilled water, at 60 degrees Fahrenheit, weighs one pound and a pint of oil weighs but three-fourths of a pound, the specific gravity of the oil would be .75.

In commerce, however, the gravity of lubricating oil is given in degrees Baume according to a conventional scale adopted by refiners and marketers of oils, in which water is taken at 10 degrees Baume as a standard. In case of specific gravity, the greater the numerals representing the same, the heavier the oil; while by Baume scale, the reverse is the case; that is, the higher the number of degrees quoted the lighter the oil.

The gravity of a lubricating oil is of small value in determining the lubricating value thereof, when considered by itself, but it becomes very important in connection with other tests, viz., Flash Point, Burning Point, Viscosity and Cold Test, as it may be determined with considerable certainty the origin of crude petroleum from which it is produced; also in detecting the presence of rosin and coal-tar oils, which are objectionable.

There are practically three methods for the determination of the gravity of an oil; first, by the use of a hydrometer; second, by use of a bottle which holds a definite amount of water by weight, at 60 degrees Fahrenheit; third, specific gravity balance. All of these are shown on the two preceding pages.

The hydrometer is the most convenient and most common instrument for this purpose, and, consequently, is almost universally adopted by oil chemists.

In general, the lighter the gravity,—the flash point, burning point and viscosity being equal—the better the oil.

### Fire Test.

Lubricating oils, kerosenes, etc., at some temperatures, give off an inflammable vapor. The temperature at which an oil will give off a sufficient amount of vapor to form a mildly explosive or inflammable compound or mixture with the air, which burns upon the application of a flame, is known as the flash point. The temperature of the oil being raised, a greater volume of vapor is given off and the production of the vapor being sufficiently rapid to maintain a continuous flame, the oil takes fire and burns; the temperature at which this takes place is the burning point, or is more commonly referred to as the fire test.

The determination of the flash point is essential, as it furnishes information as to the amount of lighter oils present; further, oils having too low a flash point are dangerous to use.

The determination of the burning point is of even greater importance, as it is the point at which the oil begins to decompose and rapidly loses its lubricating properties and value.

There are two kinds of apparatus used for the determination of the flash and burning points of oils, viz., open and closed cups, the former being used for lubricating oils, and the latter for kerosenes, naphthas, etc.

In making the fire test, the cup contained in the support or body of the open cup is filled with the oil to be tested, within approximately one-half inch of the top. The thermometer is suspended from the support at the side so as to bring the mercury bulb as near the centre of the body of oil as possible. Heat is then applied and the temperature raised until the 200 degrees Fahrenheit (for engine oils) or 300 degrees Fahrenheit (for cylinder oils) mark is reached. The heating is then sufficiently controlled to maintain a uniform rise in temperature of the oil, of not less than 8 degrees, nor more than 12 degrees, per minute. At every 5 degrees rise in the temperature of the oil, as shown by the thermometer, a small gas flame or burning taper, giving a flame about one-quarter inch long, is passed gradually forward and backward, approximately one-half inch above the surface of the oil. When a sufficient amount of vapor is generated, it will burn with instantaneous flash. The temperature at which this takes place is recorded as the flash point of the oil. The heating is continued, and the temperature increased at the same rate; the flame is passed over the surface at every 5 degrees rise, as before, up to a point where the oil takes fire and continues to burn until extinguished by the operator. The temperature at which this occurs is recorded as the burning point.

### Viscosity.

The term viscosity implies internal friction of a liquid. Therefore, the determination of the viscosity of an oil is the comparative measurement of its internal friction. Preceding the introduction of the products of petroleum as lubricants, the question of viscosity did not interest oil consumers or producers, as, up to this time, comparatively few animal or vegetable fats or oils were available, and the viscosity of these varied but little at the temperature under which they were to be used.

All oils exhibit viscosity, but in widely varying degrees. In the hands of those accustomed to the handling of oils, a comparatively rough idea of the viscosity of an oil may be obtained by shaking it in a bottle, or by inverting the bottle, so as to entrap an air bubble at the lower end, noting its rise through the body of the oil; but this is not sufficiently accurate to avail the operator much; consequently, it is necessary that a properly constructed viscosimeter be employed. Many forms of apparatus for this purpose have been produced, but only two are in general use, viz.: the Saybolt and the Tagliabue. The former not being obtainable in the open market, the latter is almost universally used by oil manufacturers and marketers. This condition, however, works no hardship, as the latter instrument gives practically the same results as the former. This being the case, only the Tagliabue instrument will be considered. The viscosity of engine and dynamo oils is taken at 70 degrees Fahrenheit, and cylinder and valve oils at 212 degrees Fahrenheit.

### Friction Test.

The Thurston Friction Machine is used for the testing of oils and other lubricants. By the use of different sized pulleys on both the motor used to drive it, and the machine itself, the speed may be adjusted to practically any number of revolutions per minute. By manipulation of certain parts of the pendulum, we can

adjust the pressure to from twenty-five to two hundred pounds per square inch. Upon reference to the thermometer, we can note, at any time, the temperature of the bearing.

The friction test constitutes essentially the determination of the amount of power necessary to overcome the resistance of an oil when applied to a bearing; the results of the test being given as the co-efficient of friction.

Except for scientific purposes, this machine is generally used in making comparative tests on two or more oils under consideration. The several oils being tested are run on the machine under exactly like conditions as regards pressure, speed, temperature or bearing at start, etc.; the oil applied to the journal through an oil well at the base of the thermometer, in sufficient quantity to prevent the temperature of the bearing from going above a certain point (usually 150 degrees F.); the oil used having been taken from a known quantity, the exact weight of which having been previously determined, it only remains to weigh back the unused portion in order to arrive at the quantity used in each case. This done, it becomes evident of which of the oils the greatest quantity was required. The results can be tabulated on a percentage basis by selecting the best of the oils as a standard, assuming it to have a value of one hundred per cent.; from the quantity of the other oils used, their comparative values can be calculated. Through the test made in this manner, the actual friction reducing power is determined.

### Chemical Examination of Lubricants.

There are certain chemical tests, or determinations, which should never be omitted, viz.: for free, fatty, or mineral, acids; kind, quantity and quality of animal or other fats used in compounding; coils is suggested by J. D. Coates in a tarry matter; grit; and cold test; this last being essential in connection with so-called ice-machine, or ammonia oils. Cup greases should be especially examined for free, or uncombined alkali, rosin, and rosin oil; as their presence is prone to cause serious trouble in the form of corrosion of the rubbing surfaces. Greases containing rosin, or rosin oil, should never be used upon brass or bronze bearings, as, due to heat and friction, they readily liberate acid, which would prove very objectionable.

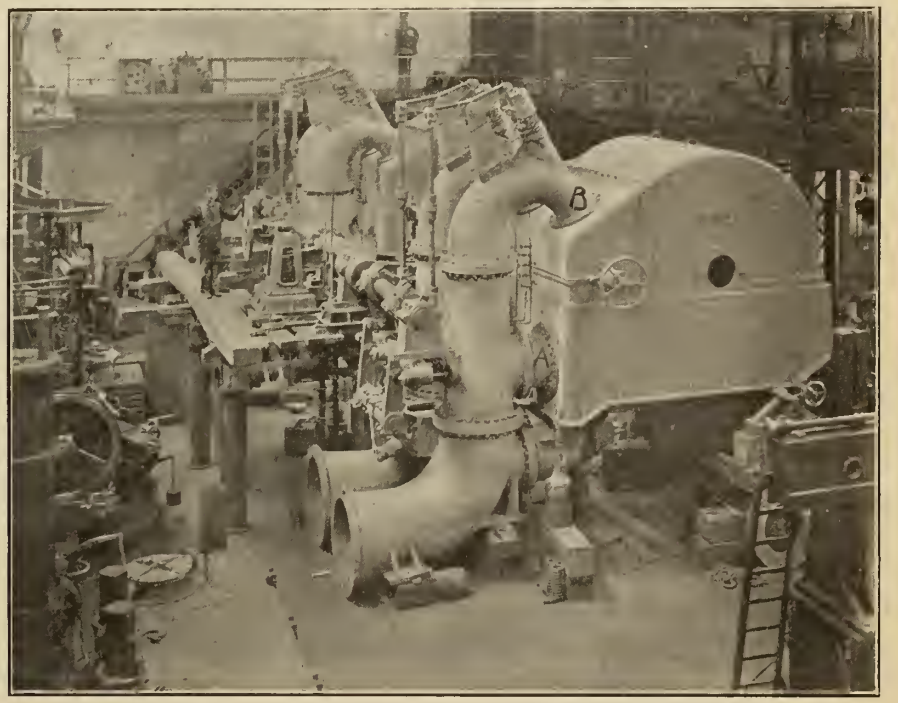
## A 10,500 H.P. IMPULSE WATER WHEEL.

The illustration shows a 10,500 H.P. Impulse Water Wheel, which was built in the shops of The John McDougall, Caledonian Iron Works Co., Ltd., Montreal. It is designed to deliver 10,500 brake horse power at 200 revs. per min. under a head of 380 feet of water. It was built for the British Columbia Electric Railway Co., to be used at Lake Buntzen, driving an alternating current generator 5,000 K.V.A., 22,000 volt, 3 phase, 60 cycles.

There are four sets of buckets, all on the same shaft, two on each side of the generator. These buckets are of the ellipsoidal type, and are made of close grained cast steel ground to a smooth finish. Each set consists of 16 buckets, 24 inches wide, forming a wheel 6 feet 10 inches in diameter.

The water enters the casing at A and B and is directed onto the buckets through two needle nozzles. These needles are connected with the Lombard governor through the levers, and lay shaft, as shown in the illustration, and move in a longitudinal direction within the nozzle, thus changing the annular area of the orifice and the amount of water discharged. The needles do not make a hollow stream, both are so shaped as to draw the water down to a solid stream before it leaves them. The springs on the needle spindles approximately balance the force of the water on the needles, thus taking the load from the governor. Underneath the wheels, at D, are the needle relief nozzles. These are so connected to the governor that should the main nozzles become suddenly closed the relief nozzles will open and allow the surplus water to run into the discharge pipe preventing shock in the inlet pipes. The needles of these nozzles are handled by dash pots so that after being wide open they will gradually close, thus preventing shock.

The main shaft is 43 ft. 6 ins. long, 20 inches in diameter at the centre, tapering to 12 inches diameter at each end. It is made of nickel steel, hydraulic forged, oil tempered and runs in four water-cooled bearings. The four cast iron inlet pipes are 36 inches in diameter, and will be bolted to a cast steel yoke pipe, 51 inches diameter. The housings are of cast iron with machined bottom flanges.




A 10,500 h.p. Impulse Water Wheel.

## POWER DEVELOPMENT COURSE.

The School of Mining, Kingston, has introduced a course in Power Development, which will prepare students in this branch of engineering. The studies include the work of the civil engineering course in first two years. In the third and fourth years the student may specialize in hydro-electric work or in steam and gas. In the first case special attention is given to hydraulic engineering and surveying, while in the second case mechanical engineering is taken up including the production of steam and gas.

Before the advent of the metallic-filament street lamp, gas lamps were largely used in English cities to illuminate the side streets, as the requirements did not justify the use of flaming arc lamps. Now the gas lamps are giving way to the metal-filament lamps, which afford a considerable saving. Nearly two thousand side street lamps at Marylebone have been changed from gas to electricity, with the result that $7,500 has been saved.

## RUNNING MACHINES IN PARALLEL

By J. A. S., Newcastle.

Present day practice in central stations appears to be tending in favor of the adoption of larger sized units of power than was the custom some years ago, and this is perhaps not only due to the fact that the capacity, either present or prospective, of a supply system is nowadays much larger than was formerly considered possible, but that also owing to the improved reliability of electrical and mechanical plant, the danger of breakdown to any individual generating unit is not so great as it used to be, and engineers are now inclined to put their risks into one unit rather than take further subdivision with its increased inefficiency, at any rate in the prime mover. In spite of this, however, it is still necessary to combine the working outputs of two or more machines, even in the best stations, either for the purpose of getting over a peak in the load or, at any rate, for changing over the load from one machine to another without interrupting supply. The question, therefore, of placing machines in parallel is yet not without interest, and one or two remarks concerning the same may be tolerated.

Dealing first of all with direct current plants, it should be remembered that a shunt wound machine, cannot be run with a compound wound machine, and vice versa. It seems almost incredible at this period in the development of electrical power supply that such an elementary fact should be forgotten, and yet one comes across stations in which the engineer in charge has attempted to combine the efforts of his shunt wound lighting machines and his compound wound traction plant. In one instance where this was attempted, the compound wound machine was supplying a fluctuating power circuit ; the shunt machine was then run up, the voltage paralleled in the usual way and the machine then switched in on to the busbars. The result was that the circuit breakers, which were of the no-load and reverse current combined type, immediately came out, and this was perhaps just as well as it saved a considerable surge of current between the two machines. After this experience both machines were again run up, but were put on separate busbars, the compound wound machines supplying the power load and the shunt wound machine the lighting.

While upon this subject of paralleling power and lighting busbars it may be interesting to note a somewhat exciting time, which occurred in a direct current station owing to a heavy sparking and injury to plug holes, when it was attempted to parallel the power and lighting busbars on the main switchboard. The position of affairs at the time was somewhat awkward. The voltage of the lighting bars was higher than that of the power bars, and the power engines were fully loaded. Owing to the heavy nature of the load on the engines the voltage of the power bars could not be raised nor that of the lighting busbars conveniently lowered. In order to assist the overload on the power engines, which was rapidly becoming serious, it was desired to parallel the lighting sets on to the power supply. The bars were therefore tied or paralleled by screwing in the plugs in the usual way, the result being that heavy sparking in the plug holes resulted, destroying them to a considerable extent, while a severe voltage fluctuation was set up. In order to guard against a future recurrence of such an unfortunate circumstance, a two pole switch of 100 ampere capacity, and provided with a quick-break action, was fitted upon the switchboard and connected so that on closing the switch, like pairs of poles on the lighting and power busbars were connected together. This arrangement allowed the bars to be instantaneously tied or broken and got over the difficulty effectively.

Turning now to the question of running alternating current plant in parallel, engineers will not need to be reminded that in the the past considerable trouble has been experienced in the parallel running of alternators, this being due not only to electrical difficulties, but also to the mechanical characteristics of the engines which were driving them. Two examples of this may be quoted. Some years ago some slow speed high tension machines, each of 200 k.w. capacity, and having a frequency of 100, were direct coupled through solid couplings, to slow speed engines which had very powerful governors in order to maintain a very close speed. Owing to the combined effect of the slow speed of the engines and the fineness of the governing very great difficulty was found in paralleling the machines with one another. In order to effect a temprary remedy the governors were altered so that the range within which they kept the speed constant was considerably greater, and the machines were then found to work in a much better manner when they were paralleled. Owing, however, to the fact that the alternators were air cored they were still not entirely satisfactory, and the evil was eventually cured by disconnecting these alternators altogether and replacing them with iron cored alternators of double the output and operating at a frequency of 50 periods. Condensing plant was added and the speed of the engines run up so that their output was increased in order to bring it up to the requirements of the generating plant. With these alterations and the wider range of the governing, parallel running was found to be perfectly satisfactory.

The other instance which may be mentioned was a case in which considerable difficulty was experienced in putting either a high speed marine engine or a large vertical type turbine in parallel with some slow speed reciprocating sets. At some times it took half an hour before the voltage and the phases synchronised sufficiently to enable the machines to be switched into parallel, owing to the large difference in speeds of the sets and the inequality of governing. These conditions not only involved difficulty in paralleling, but occasionally the machines at certain loads fell out of step, while they were running and considerable hunting took place. The slow speed engine was of the compound type direct coupled to the alternator, while the turbo generator had electrically operated valves. The governor of the slow speed set was not by any means so sensitive as that of the turbine, and consequently as the load increased the voltage of the slow speed set tended to remain high longer than the voltage of the turbo generator ; consequently the slow speed alternator became overloaded, and then rapidly fell out of step. In this instanee, although careful adjustment of the governors had been applied, very little success resulted, and the only thing which apparently remained to be done was to get rid of the slow speed sets which took up a considerable amount of floor space, (which in addition to their governing performance, was somewhat against them), and to substitute in their place either high speed engines of the marine type or further turbines.

In conclusion it may be interesting to rebut by actual experience the scepticism with which some engineers have regarded the parallel running performance of the latest form of prime mover for central station practice, namely, the gas engine, at any rate, as regards alternating current practice. In spite of the doubt with which gas driven alternators are regarded, it may be interesting to state that in the case of some vertical three-cylinder gas engines which were direct coupled to iron cored alternators, each of 150 k.w. capacity and running at a frequency of 50 cycles per second, no difficulty whatever was found when putting two of these machines in parallel. As a matter of fact the paralleling current was less than is usually the case with steam driven machines, and the speed of the engines could be varied at will.

So far as tests have been made public there is also no reason to doubt the paralleling performances of the larger sized gas engines, which are now coming on to the market, and it is therefore to be hoped that before long we shall see central station plant of large capacity operated by means of these prime movers.

## RECENT MEETINGS OF SOCIETIES.

The annual meeting of the Ottawa Branch of the Canadian Society of Civil Engineers was held on October 6. The election of officers for the year 1909-10 resulted as follows : Chairman, W. J. Stewart ; managing committee, Arthur Bruce, A. A. Dion, A. T. Phillip, R. Donaldson, Naulon Cauchon ; secretary, S. J. Chapleau, resident Engineer's office, Department of Public Works. A reading and writing room for the branch is being opened at 177 Sparks St.

Members of the Fredericton, N.B., University Engineering Society held their annual banquet at Windsor Hall, Nov. 15, and it passed off very successfully. J. B. Alexander, president of the society, was chairman and there were about seventy present, including Mayor Chestnut, Chancellor Jones and members of the faculty, in addition to the engineering students. A full course dinner was served, and at its conclusion speech making was in order. Toasts to the city of Fredericton, Alma Mater, Engineering, Forestry and Arts departments, ladies, athletics, the press and different classes, were proposed and duly honored. The gathering dispersed about midnight with the singing of the national anthem.

## TORONTO BRANCH C. S. C. E.

Allen Hazen of Hazen & Whipple, New York, and consulting engineer for the city of Toronto, gave an address before the Toronto branch of the Canadian Society of Civil Engineers, Nov. 15 on "Pure Water Supply." Mr. Hazen showed slides illustrating the various filtration plants now in use in both Europe and America. That at Albany, New York, after which the Toronto system is designed, was especially fully illustrated.

A feature of most of these was the curtailment of waste by means of metering systems. By the installation of meters controlling the use of water the per capita consumption of water in many European and American cities had been reduced in a very great degree. Some such system, the speaker said, would have to be adopted by Toronto before the filtration plant went into operation, because the per capita consumption of water in Toronto was increasing very rapidly, and the proposed scheme for Toronto allowed for only a small per capita waste.

So general was the custom of purifying water becoming on this continent that the amount of water being purified by artificial means had doubled each year now for a number of years. J. G. G. Kerry, C.E., President of the Toronto branch of the society, presided at the meeting.

Michael Chapman, A.M.I.E.E., read an interesting paper at the Engineers' Club, Nov. 18, on "Producer Gas Plant Practice." After a brief history had been given, the practical side of the subject was dealt with at some length. Facts and figures relating to the cost and methods of operating plants were quoted.

## TWENTIETH MEETING OF THE OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.

The twentieth meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers was held at Lima, O., Nov. 19 and 20. Papers presented holding particular interest for readers of The Power House, were as follows :— "Power Costs for Factories," by F. W. Ballard, president of the society and manager of the engineering and construction department of the Sherwin-Williams Co., "The Darling Oil Gas Producer," by A. B. Davis, chemist for the Indianapolis Gas Co., Indianapolis; "Turbine Pumps," by Wetmore H. Titus, assistant chief engineer, the Dayton Hydraulic Machinery Co., Dayton, and "Some Notes on Coal and Ash Handling Equipment," by David Gaehr, contracting engineer, Cleveland.

## OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS.

The follwoing new officers were at the last annual meeting held at Lima, Ohio, November 19-20, 1909:—

President, O. F. Rabbe, c|o. Toledo Railway & Light Co., Toledo, Ohio., or 430 Floyd Street; Vice-president, Grant Miller, c|o. Citizens Lighting & Heating Co., Toledo, Oho, or 131 Ontario Street; Secretary-Treasurer, Prof. F. E. Sanborn, Prof. Industrial Arts and Director of Industrial Arts, Department of Ohio State University, Columbus, Ohio; Managers, Ira Cole (in place O. F. Rabbe, elected president), c|o. Gas Power Producing Co., Lima, Ohio; C. T. Baker, 809 Scott Street, Covington, Ky.; E. M. Adams, Chief Engineer, the Quaker Oats Co., Akron, Ohio, or 152 S. Balch Street.

The next meeting will be held in Cincinnati, in spring of 1910.

## STRATFORD C. A. S. E.

The officers of Stratford Local Branch of Canadian Association of Stationary Engineers, met Dec 1, in a pleasant evening of good-fellowship, the occasion being a parting farewell to John Passmore, who leaves for Hensall, to go into business for himself, having purchased the Hensall Electric Light plant. The presentation was made by John Robertson, and the address, which is as follows, was read by W. G. Walter:—

John Passmore, Esq.,

Stratford, Ont.

Dear Sir and Bro.,—

It is with profound regret that we have learned that it is your intention to depart from our midst, and take up your residence in a distant town. From our knowledge of your high character and your ability as an engineer, we are confident that you will make your undertaking a success. We appreciate the fact that your removal from our lodge, removes one of its strongest supports, but we trust that in your new surroundings you will find time and opportunities to advance the interests of the stationary engineer. In our business transactions in the lodge we have been well advised by your wise and careful judgment. In our hours of social entertainment we have enjoyed your good natured comradeship, and in our uphill work of forming an association, we had your unselfish devotion until to-day, when we meet to bid you farewell. We have an association to be proud of.

We hope that you may have rich success in your undertaking, and that you will have health and happiness. We will receive with interest tidings of your work and welfare. In parting with you we ask you to accept this umbrella as a small mark of our esteem for you.

Signed in behalf of the Lodge.

W. G. WALTER,
JOHN ROBERTSON,
ALEX SCRIMEGEOUR.
GEORGE HERD.

The Stratford Lodge has about 40 members. On Nov. 24, a member was elected to represent the lodge on the Stratford Board of Trade. On the same evening Bro. Castello, C.E., of the G.T. R. power house, gave a lecture on "Boiler Construction."

John Fisher, who has been in the Stratford Hospital with injured eyes, is around again.

It is the intention of the Stratford lodge to hold a banquet at an early date.

# Modern Elevated Reinforced Concrete Coal Pockets

Recently Completed for Hart & Adair Coal Co., McGill Street, Montreal —Construction is Most Modern – Up-to-date Equipment has been Installed

By WALTER J. FRANCIS, C.E. *

The new reinforced concrete coal pockets shown in Fig. 1—recently completed by Byers & Anglin, for the Hart & Adair Coal Co., at Montreal, are of the latest type of structure for the storage of coal. The building complete was designed by Adolphe Suck, Boston, and erected under his supervision. This particular structure is the first of the kind in Canada. Its capacity is 6,000 tons. There are several similar buildings in the United States all by the same engineer and all built within the last three years.

Fig. 1.—General View Hart & Adair Coal Pockets.

Reference to the illustrations will show that the bins proper are carried on four rows of octagonal columns, giving a clear headway of 11 feet above the ground. The bins, which are 25 feet deep, are surmounted by a working floor carrying a conveyor system for distributing the coal from the elevator to the various bins. The upper storey enclosing the conveyor system is of wood roofed over flat and covered with felt and gravel roofing, laid according to the Barrett specification. The coal is delivered in hopper bottomed cars, which empty into a hopper under the siding. This hopper is in turn emptied by the elevator system, which conveys the coal to the two distributing belts over the tops of the bins. The main columns extend to the tops of the bins, and are specially formed with vertical cheeks to permit the introduction of 3-inch plank partitions. In this way bins may be formed from column to column throughout the structure or as many partitions may be omitted as desired to give bins of large size. With the exception of the top covering and the bin partitions the whole structure is of reinforced concrete. The general arrangement of the siding, elevator and roadways under the structure may be clearly seen in Fig. 1.

Provision has been made for future extensions lengthwise at the end facing the observer, the corbels for the new beams being seen on the end columns. The other end of the building is the permanent one, and is semi-cylindrical in form.

Transversely of the building the columns are placed at 17 feet centres forming four bays or wagonways. Longitudinally the columns are 18 feet apart, centre to centre. Rock is found almost at the ground surface. At the site of each column the loose rock was excavated 5 feet square and a layer of 2 inches of sand was put in before the concrete roofing was deposited. Just above the ground level the column section is contracted to an octagon of 35½ inches diameter. The main beams or girders run lengthwise of the building, those under the outer walls having a section 22'' x 41½'', the centre three being 24'' x 48''. The transverse beams over the columns have a section 18'' x 31½''. There are also two intermediate transverse beams dividing the bay, or floor of the bin above, into three equal panels 3 feet wide. Each of these intermediate transverse beams has a section 18'' x 25½''. The floor of the bins is 5¼'' thich.

All the columns extend above the floor to the full height of the bins and are tied across the tops by reinforced concrete beams. These latter beams are 10 inches deep and 27½ inches wide for the longitudinal ones, while those running transversely of the building are 10 inches deep and 25½ inches wide. In the middle of each of the sides of the bins is a vertical column, extending from the floor to the top of the bins. In the exterior walls these serve as buttresses to the concrete walls, while for the other bin sides they shorten the span of the parti-

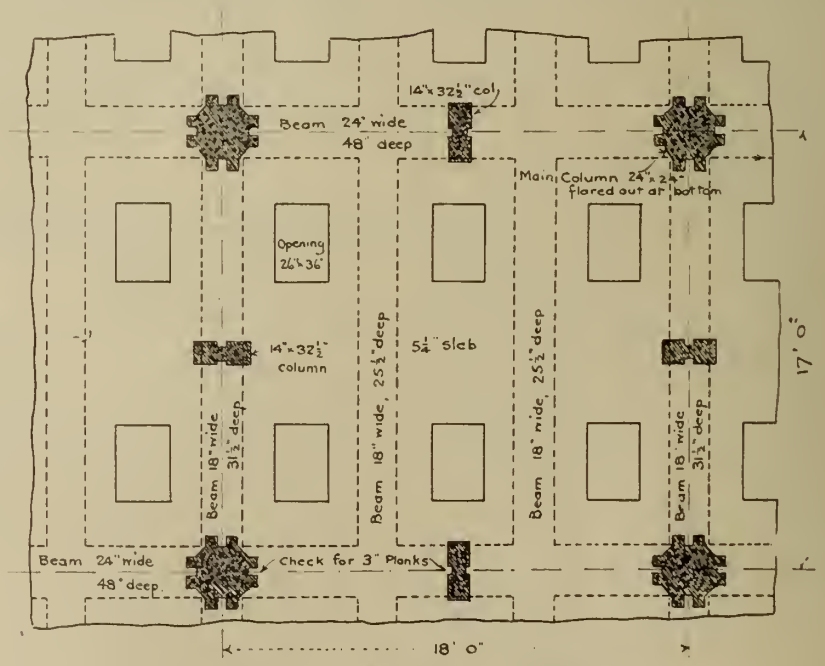



Fig. 2.—Plan of Hart & Adair Coal Pockets.

* Consulting Engineer, Soverign Bank Bldg., Montreal.

tion planks so that only 3 inches thickness of spruce is required for this purpose. These intermediate columns are 14'' x 32½'', while the main corner columns are 24 inches square, with a wide base. The general arrangement of bin will be seen by referring to Fig. 2. Fig. 3 shows a general transverse section of the structure. The exterior walls vary in thickness from 6 inches to 5½ inches to 5 inches to 4 inches, the change taking place abruptly on the inner face at intervals of 6 feet 3 inches in height.

Throughout the work plain round, mild steel rods were used for reinforcing. As typical construction the steel skeleton of one of the main longitudinal floor beams and one of the corner columns in the bins will be described.

Fig. 4 gives a diagram of the reinforcing of one of the large beams. Its heavy reinforcement as well as the provision for continuous beam action are worthy of special note. The concrete section is 24 inches wide and 48 inches deep, to the top of the floor. The bottom corners are slightly chamfered. Underneath the floor slab there is a wide straight fillet 8 inches each way, and over the columns a haunch 9 inches deep and 15 inches long. It will be observed that the main loads on this beam occur at the two intermediate cross beams, giving a concentrated load at each of the third points. The reinforcing consists of five 1¼-inch round rods 4½ inches apart, and 2¾ inches above the bottom of the beam, their length being 17 feet 8 inches, that is 4 inches short of the distance, centre to centre of columns. A second tier of five 1¾-inch

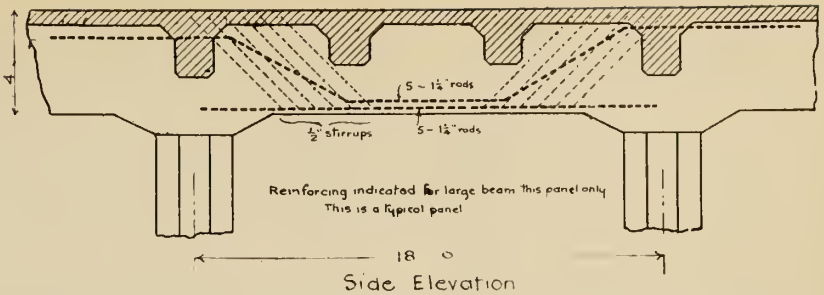



Fig. 4.—Reinforcing of Large Beam.

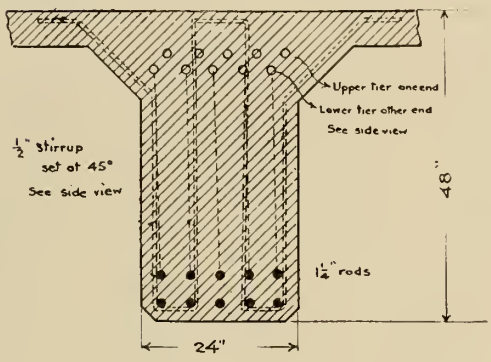



Fig. 5.—Section of Reinforcing.

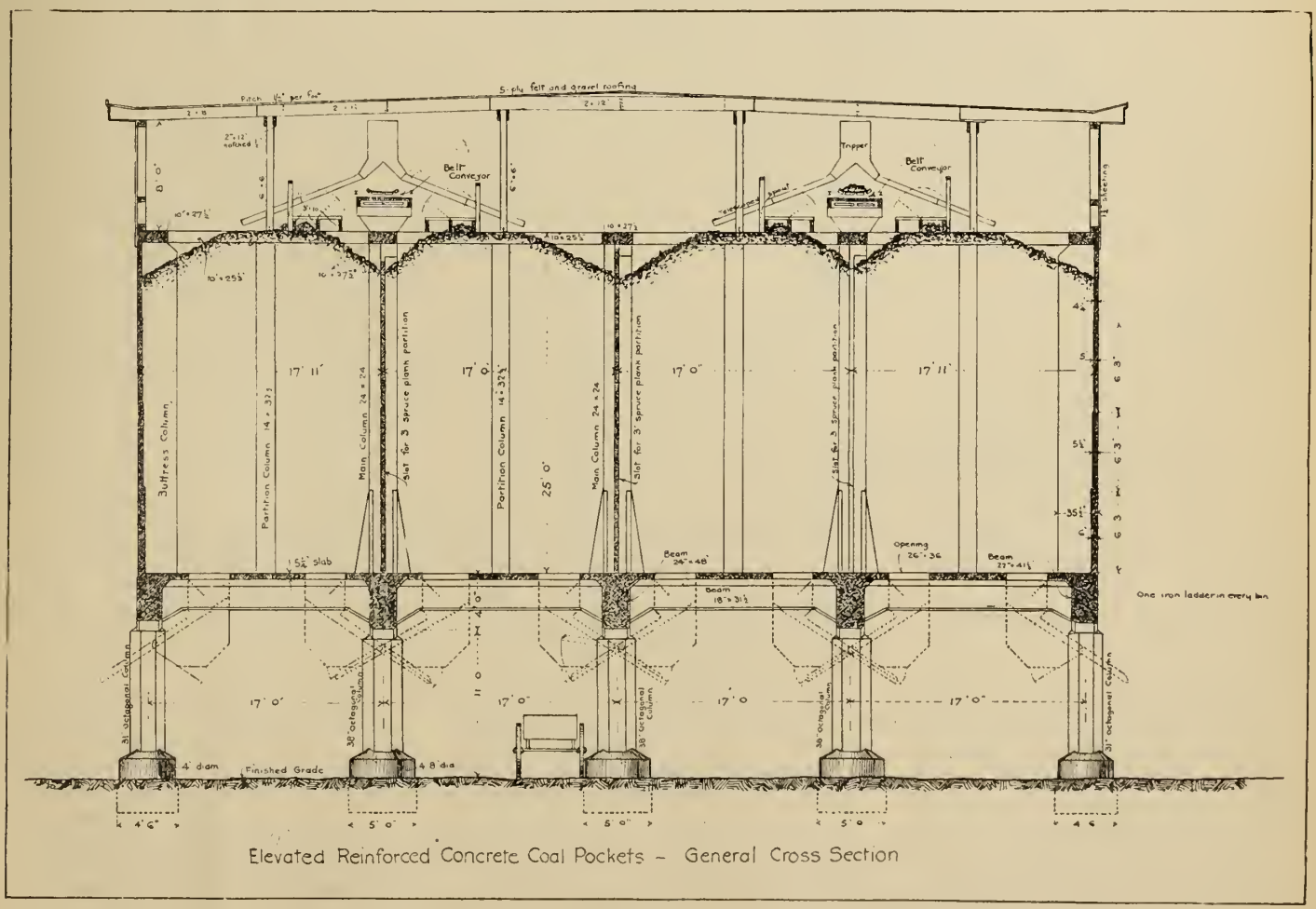



Fig. 3.—Hart & Adair Coal Co., Montreal—Elevation of Reinforced Coal Pockets.

round rods bent as shown on Fig. 4, is placed 4½ inches above the lower set. These bent rods have their ends extending 5 feet 6 inches past the centre of the columns, and to allow for the lapping of the corresponding rods of the adjacent beam, one end is set up 2 inches higher than the other. The centre 6 feet of length is straight. The rods are wired to stirrups made of ½-inch round, as shown on Fig. 4. The stirrups, six at each end, are placed 8 inches apart and inclined at 45 degrees. It will be noted that the shape of the stirrup conforms with the fillets on the side of the beam.

The column reinforcement below the bins consists of eight rods ⅝-inch diameter, placed at the angles of an octagon, 2 inches from the outside face of the column. The octagonal shaft of the columns is 8 feet 9 inches long. In this height there are twelve ⅝-inch hoops, 6 inches apart at the middle, the spacing increasing gradually up and down until the hoops are 12 inches apart. Above the bin floor the columns perform a different function, inasmuch as any set of partitions may be in and a full bin may be adjacent to an empty one; consequently beam action must be provided for. To care for these stresses, there are four 1½ inch rounds in each side, 2 inches from the outside. At the base, the bottom 6 feet of the column is flared out and the rods are spread out like tree roots, their extreme ends embedded in the floor beams, being 5 feet from the column centre. The intermediate partition columns are reinforced with rods to take the beam action, the ends being bent slightly inwards to enter the supporting beams at the floor and top of the bins.

The floor reinforcing speaking generally is of 9-16-inch and ½-inch rounds, 9 inches apart, placed 1 inch from the top and 1 inch from the bottom of the floor slab. The outside wall reinforcing generally consists of horizontal rods 1 inch from the outer surface at about 6-inch centres, varying from ½-inch at the bottom to ¼-inch at the top of the bins. Staggering these at the buttresses are 4 feet rods 1 inch from the inside face of the walls, the size varying as in the main wall reinforcing rom ½-inch to ¼ inch.

The concrete for the work was made as follows:—For foundations 1.3:5; for beam and column work, 1:2:4, with 1:2:2 for a thin layer in beam bottoms. For all beam and column work the stone was ¾-inch, screened from all dust. Canadian Portland Cement was used throughout. The mixture was made quite wet, and the surfaces are very smooth.

Concreting operations were commenced in the middle of June and completed about the middle of September. All concrete was machine made. Advantage was taken of the elevator shaft pit in which to set the mixer, so that all materials were dumped down into the machine, from barrows, in which it was wheeled from the stock piles along the siding.

## ADVANCE IN MARINE ENGINEERING.

The advance of marine engineering in the few short years of the present century is related in a paper by Mr. Maginnis at the Liverpool meeting of the Institution of Mechanical Engineers.

Since 1872, pressures have advanced each decade, as follows, approximately: 52, 77, 158, 197, 195 pounds per square inch. Coal consumed per indicated horse power hour has been 2.11, 1.83, 1.52, 1.48, 1.48. Thus the turbine has apparently checked further rise in pressure, and has not reduced coal consumption. Any possible further coal economy has been, in fact, sacrificed to other advantages, though we may hope to see the reduction of coal per horse power hour continue after a period of rest.

No turbine steamer has been towed into port, and no sailing schedule has been upset by failure thus far.

The chief trouble with turbines has been the ratio of the turbine speed to the propeller speed. It is anticipated that there should soon spring up a revival in the re-engining of vessels similar to the revival in the Seventies, when simple engines were changed to compounds.

There are now sixty-four turbine steamers in the merchant service of 603,200 horse power; this is up to December, 1908. In 1901 there was but one steamer, of 3,500 horse power. A good deal is being done in combining high-pressure engines with low-pressure turbines, or, rather, in adding a turbine to triple or quadruple engines, which exhaust at so high a pressure that a turbine will work very well on the remainder with a good vacuum.

The propeller question is still very empirical. The improved results with the great Cunarders, which at first were, in a sense, failures in regard to required speed, have been got by varying the propellers. This reminds one of the steamships Iris and Mercury in 1878, when huge improvements were made by changing the propellers. It all shows that very little is really known about propellers.

Boilers have not changed much, except that they are built of larger plates with fewer rivets. The largest plate rolled measures 42 feet by 9 feet 6 inches by 1½-inch thick. It weighs nearly 11 tons, and is in the boiler of a Liverpool tugboat, the Knight Errant.

The lower pressure possible with turbines has meant a saving of 120 tons in boilers alone in the great Cunarders, as compared with what would have been required for reciprocating work.

Marine work is backward in the moving and firing of coal. Liquid fuel, of course, gets over all such difficulties, and suggests that if coal could be bunkered in the form of fine dust and burned in that form it might be possible to arrange some mechanical means of conveying it to the furnaces.

Liquid fuel is practically equal to double its weight of coal, yet occupies less space. There are no dirty fires with liquid fuel; a ship is better kept to speed. Fewer hands are needed, fuel can be carried in the double bottom, and the ship trimmed by sea water as the fuel is burned, and fuel can always be used so as to avoid a list. Bunkering is merely a matter of pumping. Travelers would esteem the change from the present coaling at Port Said. East of Suez, liquid fuel is cheaper than coal.

With liquid fuel applied to the Lusitania, there would be 27 firemen instead of 312, room for 200 more passengers and 5,000 tons of cargo, so that it should be worth £7,000 per voyage. Unfortunately liquid fuel is scarce. Its production is comparatively small, and if largely adopted the enhanced price would much reduce the economy at present apparent.

Internal combustion engines have so far made little progress on ship-board.

There is some talk of electric driving and of using turbines and high-speed generators and slower electric motors. The propeller could then be controlled from the bridge.

The electric turbine drive seems to be best adopted for the tramp steamer, with its moderate propeller speed.

Modern ships have a tendency to revert to more moderate speed, and it appears to be thought that the Mauretania and Lusitania will not be equaled for a long time.

## MUST HAVE SAFE BOILERS.

All United States steamship companies received directions to equip the boilers of their vessels with an independent water feed by October 31, from Assistant Secretary McHarg, of the Department of Commerce and Labor, Washington, under penalty of having their licenses revoked.

# PRACTICAL ARTICLES BY OUR READERS

**Readers are Invited to Contribute to this Department with Short Articles or Comments — We Pay for all Available Material.**

### PRACTICAL ARTICLES.

We wish to devote a few more pages each month to this department and in order that it may be successfully kept up we desire to hear from a greater number of our readers. Some articles have started discussions out of which some good information has resulted, and if even five per cent. of our subscribers will write us we will have some excellent material for months to come. Decide to-day to be one of the five per cent.

Have you any special methods or devices that you find useful in the engine or boiler room? If you have, write to us about it in your own words. Illustrate, if possible. The sketch may be rough, but we will attend to that. If your article is acceptable we will arrange it for publication and pay you liberally for it.

The only stipulation is that the article must give a useful idea. It may be an old device that you have not thought worth writing about before, but it may be just the thing another engineer or fireman is looking for. Address, The Power House, 10 Front St. East, Toronto, and it will reach the editor.

### LOCATING ANGLE BELT DRIVES.

The accompanying illustration reproduced from Machinery is a date sheet of angular belt drives. The diagrams show all the different positions of the pulleys for different directions of rotation of the shafts, and are also applicable to shafts in any position, vertical or horizontal.

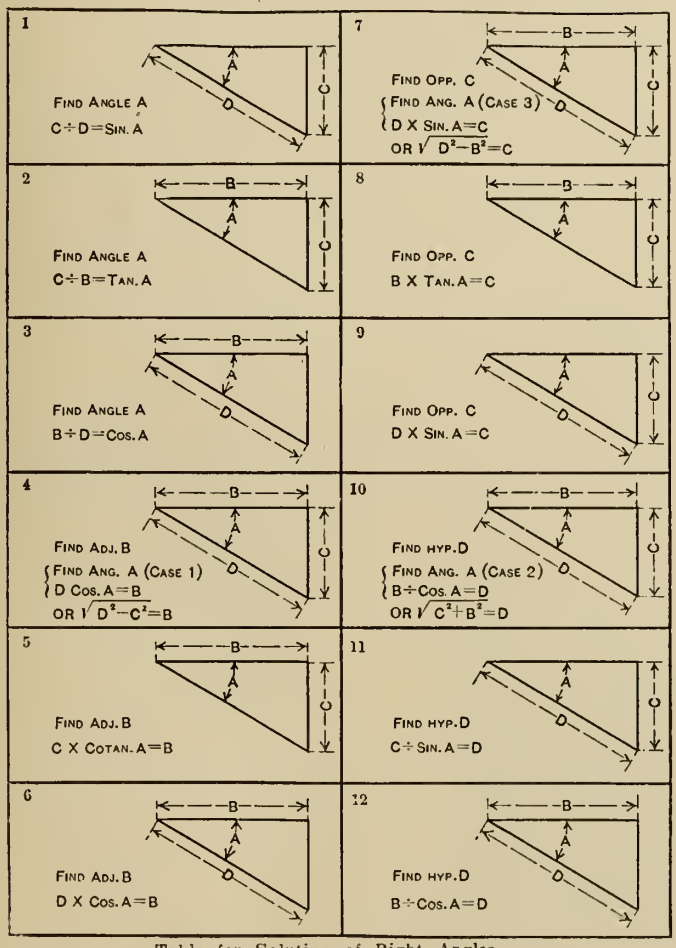
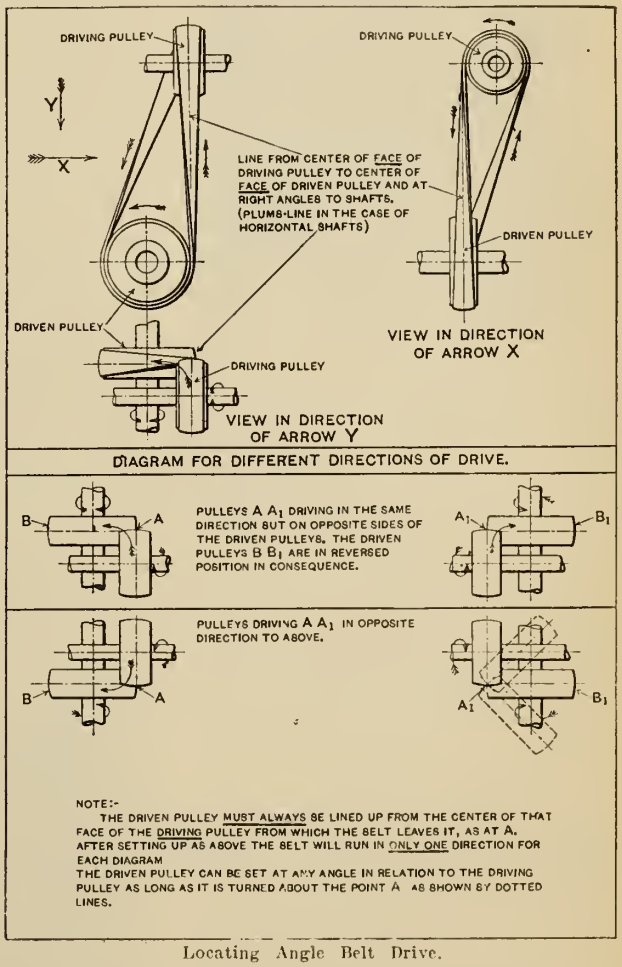



Table for Solution of Right Angles.


DRIVING PULLEY
DRIVING PULLEY
Y
X
LINE FROM CENTER OF FACE OF DRIVING PULLEY TO CENTER OF FACE OF DRIVEN PULLEY AND AT RIGHT ANGLES TO SHAFTS. (PLUMB-LINE IN THE CASE OF HORIZONTAL SHAFTS)
DRIVEN PULLEY
DRIVEN PULLEY
VIEW IN DIRECTION OF ARROW X
DRIVING PULLEY
VIEW IN DIRECTION OF ARROW Y
DIAGRAM FOR DIFFERENT DIRECTIONS OF DRIVE.
PULLEYS A A1 DRIVING IN THE SAME DIRECTION BUT ON OPPOSITE SIDES OF THE DRIVEN PULLEYS. THE DRIVEN PULLEYS B B1 ARE IN REVERSED POSITION IN CONSEQUENCE.
PULLEYS DRIVING A A1 IN OPPOSITE DIRECTION TO ABOVE.
NOTE:-
THE DRIVEN PULLEY MUST ALWAYS BE LINED UP FROM THE CENTER OF THAT FACE OF THE DRIVING PULLEY FROM WHICH THE BELT LEAVES IT, AS AT A. AFTER SETTING UP AS ABOVE THE BELT WILL RUN IN ONLY ONE DIRECTION FOR EACH DIAGRAM
THE DRIVEN PULLEY CAN BE SET AT ANY ANGLE IN RELATION TO THE DRIVING PULLEY AS LONG AS IT IS TURNED ABOUT THE POINT A AS SHOWN BY DOTTED LINES.

Locating Angle Belt Drive.

### HANDY TABLE FOR THE SOLUTION OF RIGHT-ANGLE TRIANGLES.

By F. J. Bouve.

The table above gives in a convenient form the rules necessary for solving right-angle triangles. To the toolmaker or apprentice who has had the privilege of becoming familiar with trigonometry, it is put up in a very handy form for reference. There are a great many who do not understand the meaning of "square" and "square root," and who will find it easier to first find the angle when two sides are given, and then find the required measurement of the third side from the angle by the rules as stated. It will be noted, however, that the formulas giving the length of the third side when two sides are given in the form of a square root is also included.—Machinery.

### KEEPING TRACK OF BELT LACER.

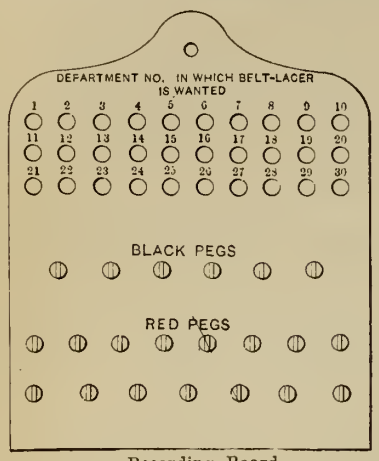
By K. Campbell.

The accompanying drawing shows a recording board, used in our shops in West Toronto, which gives the number of the department in which the belt lacer is at work and also indicates where he is wanted. Before this simple device was used, there was a lot of waste time looking for the man who looked after the lacing of belts.

The board has thirty holes at the top, each having a number corresponding to a department. At the bottom of the board are additional holes, containing six black pegs and fifteen red pegs. These latter are numbered from 1 to 15. When belt lacer is wanted one of the numbered red pegs is put in the

hole at the top to show the department where a belt requires attention.

When the belt lacer returns he sees at a glance where he is wanted. Before leaving he replaces the red peg with a black one. The first one uses red peg


DEPARTMENT NO. IN WHICH BELT-LACER IS WANTED
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30
BLACK PEGS
RED PEGS
Recording Board.

1, the second one requiring his services uses 2, etc., so that the belt lacer can tell where to go first. By using the black peg the belt lacer can be easily reached in an emergency.

## FORMULAE FOR AIR LIFT PUMP.

At the present time users of air lift pumps have to depend upon makers for data when conditions are not simple. So many variables enter into the calculations that a good mathematical analysis producing simple, intelligible formulae has not yet appeared, although the theory is well understood. For one case, however, a simple formula is in use. When the distance from the discharge end of the pipe to the surface of the water is 40 per cent. of the distance from the discharge end to the point where the air pipe discharges into the suction,

$$G = 125\frac{f}{l}$$ —where G = number of gallons of water raised per minute; l = lift in feet from surface of water to point of discharge; and f = cubic feet of free air used per minute.

## THE VALUE OF DRY STEAM.

### The Necessity for its Use and the Resulting Advantages.

By S. R. Sheldon.*

It may not be necessary to provide every engine with a separator for the sake of protection from water in the cylinder, but the fact still remains that every engine should be furnished with dry steam because of the economy that comes from its use, and because dry steam can be obtained at the engine with a comparatively simple apparatus that requires no attention, and at a merely nominal cost.

Modern engineering practice calls for dry steam, and makes use of separators to obtain it, for, while superheating and slow evaporation can be used, these methods are not generally applicable or satisfactory: and even though the steam as it leaves the boiler is comparatively free from moisture, it is in evidence, as a result of very careful investigations and observations by steam experts, that about 3 per cent. of water is nearly always present in the steam as it enters the engine, and that it also sometimes exceeds 50 per cent., part of this water being carried from the boilers and the rest being due to condensation.

The presence of water in steam is due to several causes. A certain amount is entrained with the steam as it leaves the boiler, unless the rate of evaporation is exceedingly slow. The quantity entrained depends upon the quantity of steam demanded at the moment and upon the type of boiler used, boilers which have a large water-carrying capacity and a large steam-liberating space throwing off less water than quick steamers.

Even with return tubular boilers, or those of the old-fashioned cylindrical type, a sudden or an excessive demand for steam will result in taking water out of these boilers, as the reduction of pressure in the engine, all through the pipe line and in the boiler, liberates the heat from the water stored in the boilers, and this flashes the water into steam. In the process—which produces violent ebullition—water enters the pipe line with the steam and rushes over to the engine unless stopped by a separator. It will be readily understood that priming of this kind may occur with boilers of ample capacity for the regular load, even when they are running at or under their rating, the momentary demand for steam simply being greater than the rate or generation at that time. Priming is very likely to occur when boilers are heavily fired and forced beyond their normal capacity.

Priming is also caused by impurities in the feed supply, water of an alkaline nature breaking up more easily when boiled than water which is neutral or of an acid nature.

The introduction into boilers of some boiler compounds or of soda in large quantities for the purpose of softening boiler feed waters also induces priming, as does the presence of oil in boilers. When to the priming occasioned by forcing is added that caused by alkalinity, or by the impurities in the water, the danger to the engines, as well as the loss in economy, is very greatly increased.

Besides the water carried out of the boilers with the steam, provision should also be made for taking care of the water that results from condensation in the pipes. A bare pipe at the average temperature and under the usual conditions will condense more than three-quarters of a pound of steam per hour for each square foot of its surface. Even with well-covered pipes there is a material loss, and a very considerable amount of steam will, therefore, be converted into water in a long or a large main steam line, or even in a comparatively short line, if it is not covered or if it is exposed to draughts. The water produced by condensation will travel in the same direction as the steam.

In carrying steam to different points, and in changing from one pipe size to a smaller one, pockets are formed, almost unavoidably, in which condensation gradually collects. Water thus accumulated is liable to be suddenly driven over to the engine, sometimes in the form of what may be designated as a "dose" or "slug" of water. Only a good separator will then avert a serious accident, for water, being practically incompressible, will cause breakage or other damage to some part of an engine if it is present with the steam to such an extent as to more than fill the clearance space in the engine cylinder. This holds true with almost any type of engine, and it is especially true with the modern high-speed engine, where all clearances are reduced to the minimum and where the balanced steam valve mechanism of the engine is usually of such a construction as to prevent even the small measure of relief sometimes afforded by the lifting of the steam valves.

In considering the economic advantages resulting from the use of live steam separators we must take into account the fact that water has a large capacity for absorbing heat. Therefore when water is present with the steam entering the cylinder of an engine it will rob the walls of the cylinder of heat, so that the steam next entering comes into contact with comparatively cold walls, which immediately condense a part of the steam. The technical term for this loss is "initial condensation." For example, the work done in an engine cylinder using saturated steam results in a certain amount of water being formed; when the exhaust valve is opened a sudden reduction in pressure occurs, a portion—sometimes all—of the water in the cylinder is vaporized, the temperature of the cylinder walls is lowered, and the heat thus stolen must be replaced from the live steam afterwards admitted into the cylinder.

If to the water resulting from work done is added any water entrained with the steam entering the cylinder, a greater

*Of Sheldons, Ltd., Galt, Ont.

amount of heat will be taken from the walls, thus increasing the loss due to initial condensation. By using a steam separator, and thus removing the moisture from the steam, the initial condensation from this cause is prevented and a corresponding gain in economical working is effected.

## SETTING THE ECCENTRIC OF A PLAIN SLIDE-VALVE ENGINE.

The following practical method of how to set the eccentric of a plain slide-valve engine before commencing to set

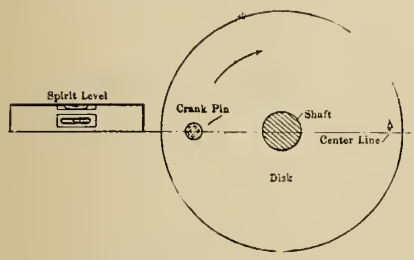



Fig. 1.—Placing Crankpin on Centre Line.

up an engine may be of some use to young engineers. First, take an ordinary level and get the centre of the crank-pin level with the centre of the shaft as in Fig. 1.

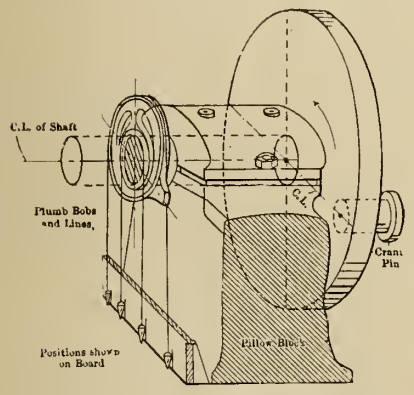



Fig. 2.—Eccentric at Right Angle to Shaft.

Then fasten a plumb-bob on each end of a line and hang them over the shaft, marking exactly their positions, either on a board placed at the back of the

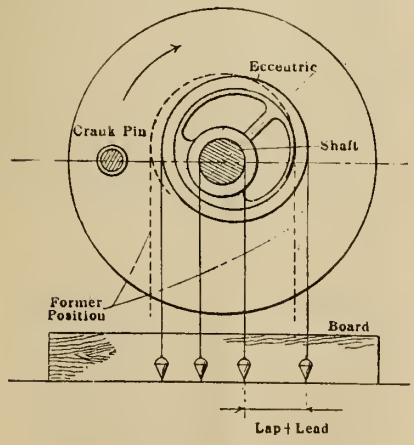



Fig. 3.—Eccentric in Proper Position.

line or where the points of the plumb-bobs touch the floor. Then place the eccentric on the shaft ahead of the crank-pin in the direction in which the engine is to run, put the plumb-bobs over the eccentric and place the eccentric in such a position that the distance between where each plumb-bob hung before and its present position is the same on both sides of the shaft, as shown in Fig. 2; then the eccentric will be at right angles to the crank. After marking the position of the plumb-bobs again, roll the eccentric over the shaft until the plumb-bobs show on one side closer and on the other side farther from the shaft, a distance equal to the lap of the value plus the lead, as in Fig. 3. Then mark the place for the key-way on the shaft or place the eccentric in permanent position with set-screws. The eccentric will then be in its proper position.—Power and The Engineer.

## AN INCLINED HYDRAULIC SYSTEM.

By Frank C. Perkins.

A novel lift system utilizing an incline plane is shown in the accompanying illustrations Figs. 1 and 2. Fig. 1 shows the inlined plane elevator car loaded with a heavy engine casting, while Fig. 2, shows the car platform of the lift in its lowest position.

Very heavy engine castings had to be transferred between the two floors of two workshops, where there was a considerable difference of level. This form of elevator was constructed as the

Fig. 1.—Incline Plane Elevator Car.

most practical and economical on account of the castings in many cases being very long and producing unequal weights on the car.

It will be noted that the car provided is very long, moving on an incline plane of concrete with rails on the platform and a track below with a hydraulic cylinder placed on the incline between the rail.

By this construction there was no trouble encountered in loading very long pieces or placing the same on one

Fig. 2.—Car Platform in Lowest Position.

side as the difference in weight on the various portions of the car had no influence on the proper working of the machine. The hydraulic cylinder on the incline in the centre of the track communicates with a vertical tank placed near the wall in the background and supplying the necessary power for raising the car. There is a valve provided in the piping connecting the cylinder with the tank, which is shut off in order that the car remains stationary wherever it is stopped. By closing this valve when the loaded car has reached the top of the incline, there is no possible way for the platform to slide down the incline. The vertical tank near the wall is connected with the compressed air piping of the factory and the working of the elevator is extremely simple.

In order to lower the car when the platform is at the top of incline the compressed air is allowed to escape and the valve between the inclined cylinder and vertical tank is opened by lifting a counterweight on the level of the cock. The car and platform reaches the bottom of the incline in about 30 seconds when the operation drops the counterweight and the valve is closed. If desired the air cock is then opened in order to be ready for immediate hoisting when desired, at the proper moment it only being necessary to again raise the counter-weight.

## BROWN AUTOMATIC ENGINE EMERGENCY REPAIR.

By Wm. Boyd.

While reading your article on Brown automatic engines, it occurred to me that it might be interesting to the readers of The Power House, who are operating Brown engines, to hear how I got over the difficulty of not having any new springs at hand to repair a broken one, under one of the latch hooks. Happening to have a flat steel spring out of a lady's corset, I made it the required length by dropping valve stem down, taking length from lock-nuts on dash-pot plunger to underneath side of latch-hook, when latch-hook was in place. By tying lower part of spring on two or three places, to the plunger rod, a very satisfactory substitute for original spring was made and ran there for several weeks till constant bending caused spring to give out.

## EMERGENCY REPAIR TO PUMP VALVE GEAR.

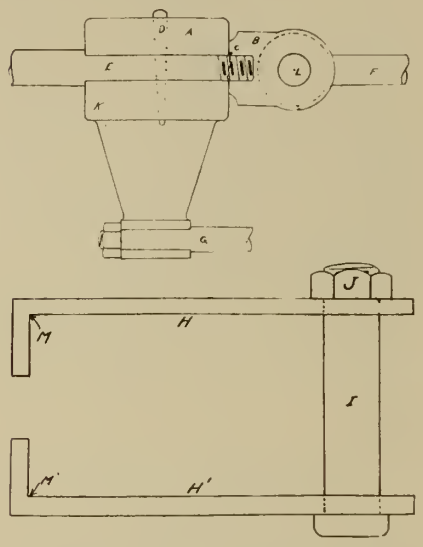
By C. W. Dunlop.

It is not infrequently the case that as insignificant a thing as a 1-16-in. cotter pin has been the direct cause of the shutting down of a 2,000 horse-power steam plant, simply because that same little split cotter pin had been left out of a 6-in. crosshead key, the key became loose and came out, a piston same in contact with a cylinder head, and most engineers know the rest.

In the case that I am about to tell of, however, the cotter pin played no particular part; but the application of the tapered steel pin served the purpose to a much better advantage. I happened in on a fellow not long ago who was making a hurried repair to a part of the valve gear on one of the pumps in the plant. All during the time my friend was getting out the different pieces I was an interested spectator.

In the accompanying sketch I have tried to show just about how the break looked in the valve gear. At A is shown the valve stem crosshead connecting to the I.P. valve stem F and the H.P. valve stem G. At C is shown where the threaded portion of the rod E broke off, directly where it enters the yoke B.

The tappet arm F connects to the yoke B by the large wrist pin at L. With this part of the valve gear broken on a duplex triple pump it was impossible to operate the pump, and with several railroads clamoring for water, something had to be done, and mighty quick at that. At H and H' are shown the two clamps that my friend heated and bent at right angles at M and M', so that they would fit over the back of the crosshead at K. A search through the old junk about the place brought forth the large bolt and nut at I and J, respectively. But, alas and alack! after the clamps were in place and an attempt was made to turn the pump over, the rod E would disengage from the crosshead on the outboard motion and thus allow the I.P. and L.P. valves to remain stationary and prevent this side from operating.




Emergency Repair to Pump Valve Gear.

"What would you do?" was put to me. "Only one thing," I replied, "and that is to drill and ream a tapering hole diagonally through the crosshead and rod, as is shown by the dotted lines at D, and your pump will run all right." This took several hours to do, but it has served the purpose for nearly a month now, and quite clearly proves how simple, yet essential, a little taper pin is.—National Engineer.

## EMERGENCY REPAIRS.

By J. A. Fitzgerald.

Some time ago I was located in a small town with no available machine shop or foundry. The strap on connecting rod broke and broke the cylinder head in five pieces. To have one cast meant a shut down for four or five days. This is how I remedied it. I gathered up the broken parts, got hold of a good blacksmith. I then painted in between the broken parts with red lead, put them all together, than I had the blacksmith make an iron band of ¾-inch square iron welded, and the exact circumference of head, shrunk this and let it cool and in a few hours after cooling replaced the cover and it is still in service with not a sign of a leak.

You may sometimes be caught without a glass guage cutter. This is how to do it. Take a match, wet the sulphur, insert inside the glass using the finger as a guide and turn around a few times until a mark has been made with the sulphur inside, then quickly light a match and apply to outside directly over sulphur. Mark, turning all the while, and the glass will break clear at the mark.

I have been troubled with a bad crank pin on a marine engine, and this is how I overcame it. I always keep some fine grindstone grit handy. I removed the brasses, filled them full of grit and oil, replaced them and started the engine up and ran it slowly. Then after a while stopped, tightened up the brasses and again started up, ran the engine for say about fifteen minutes, then took off the brasses which were very smooth and the pin had a fine polish, filed the high places, replaced the brasses and the trouble ceased.

## BURNING ASHES.

The contention that coal should be burned as completely as possible when it is first on the grates, and that the practice of refiring any of it, is more often a source of greater loss than it is of economy, is well borne out by the following results of recent tests conducted by the Arthur D. Little Laboratory, of Boston.

Just previous to these tests some of the grate bars had burned out very rapidly and allowed a considerable amount of coke and siftings of coal to be taken out in the ash conveyor.

The better part of the ash pits was returned to the coal conveyor and delivered to the overhead bins, where it was mixed with the coal and was being reburned at this time. At first thought this was considered to be the proper thing to do, but a sample of the coal and ashes being fed to the boiler indicated that there was a considerable increase in the percentage of ash in the fuel being fed and that the loss due to unburned coke invariably increased with this percentage so that instead of feeding to the stokers New River coal, which contains about 6 per cent. ash, this material contained 11.74 per cent. ash.

The ashes and refuse being taken from the pits contained nearly 40 per cent. of combustible, which, based on the high percentage of ash in the coal being fed to the stokers, corresponds to a loss of 8.3 per cent. This is undoubtedly greater than was the original loss which it was attempted to recover.

From these analyses and the analysis of refuse being put into the coal bunker the chemical engineers calculated the amount of ashes being refired to be about 16 per cent. of the coal.

---

A square foor of uncovered pipe, filled with steam at 100 pounds pressure, will radiate and dissipate in a year the heat put into 3960 pounds of steam by the economie combustion of 396 pounds of coal. Thus, 10 square feet of bare pipe corresponds approximately to the waste of two tons of coal per annum.

# Correspondence and Discussion on Previous Articles

Discussion is Welcomed on Articles Appearing on the Previous Pages.
We Will Remunerate You for Letters Containing Useful Ideas.

### HEATING SURFACE.

Will some reader kindly furnish us with simple and complete formulae to find the radiating surfaces required for heating dwellings, workshops, etc., by steam and hot water?

Geo. Burniston.

We find in the Technical Book Department of the MacLean Publishing Co., 10 Front Street E., Toronto, a book of 265 pages, "House Heating by Steam and Water," by Chas. B. Thompson, dealing with improved methods of instaling heating apparatus in the home, short and accurate rules for computing radiation, heat losses, etc., graphic charts showing boiler, power and coal consumption, etc. The following data is taken from this book:

A rule used by a number of steam heating contractors for computing the quantity of radiation necessary to warm rooms by low pressure steam heating apparatus is as follows:

1 sq. ft. radiation to 2 sq. ft. exposed glass.

1 sq. ft. radiation to 20 sq. ft. exposed wall.

1 sq. ft. radiation to 200 cu. ft. air.

Mr. Thompson does not agree with this rule, though it can be relied upon to give good, average results. He suggests 1 sq. ft. radiation to 12.5 sq. ft. exposed wall, and 1 sq. ft. radiation to 4 sq. ft. exposed glass, if windows are tight. For hot water heating add from 50 to 60 per cent. to this amount.

Mr. Thompson deals fully with the transmission methods of calculation for houses and factories, and says that the radiation necessary to warm a given space at any difference in temperature between the two sides (outside and inside), and for any given number of changes of air per hour, can only be correctly determined by computing the loss of heat by cooling or transmission in B.t.u. per hour through the different material, and dividing the sum of the loss by the heat emitted by one square foot of radiation in one hour.

The following is a table of B.t.u. per hour for one degree difference of temperature, on two sides of material:

| | Sq. ft. | B.t.u. |
|---|---|---|
| 8-in. brick wall ... .. | 1 | 0 46 |
| 12-in. brick wall ... .. | 1 | 0.32 |
| Frame construction .... | 1 | 0.32 to 0.64 |
| Single window ..... | 1 | 1.03 |
| Double window ... .... | 1 | 1.52 |

Ceilings close to roof, same as walls.

For one change of air per hour, one B.t.u. will raise the temperature of 50 cu. ft, air one degree F. Then the cubic contents multiplied by the temperature difference between outside and inside, divided by 50, will give the heat required in B.t.u. per hour to warm the air. If the temperature difference is 70, and the cubic contents 2,250, we multiply the latter by the factor 1.4, which is obtained by the division of 70 by 50. From these co-efficients is obtained the multipliers for the varying temperatures, as in the accompanying table.

The important factor is "temperature difference," zero outside to 50 deg. inside is the same as 20 deg. outside to 70 inside.—Editor.

MULTIPLIERS FOR VARYING TEMPERATURES.

| Column Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| External Temp. F. degrees | 40 | 30 | 20 | 10 | 0 | —10 | —20 |
| Internal Temp. F. degrees | 70 | 70 | 70 | 70 | 70 | 70 | 70 |
| Temperature difference | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| Multipliers for 1 sq. ft. single glass | 32 | 42 | 52 | 62 | 72 | 82 | 92 |
| Multipliers for 12" wall | 10 | 13 | 16 | 19 | 22 | 25 | 28 |
| Multipliers for cu ft. air (1 change per hr.) | 0.6 | 0.8 | 1.0 | 1.2 | 1.4 | 1.6 | 1.8 |
| Multipliers for cu. ft. air (2 change per hr.) | 1.2 | 1.6 | 2.0 | 2.4 | 2.8 | 3.0 | 3.8 |
| Multipliers for cu. ft. air (1 change per hr.) | 2.4 | 3.2 | 4.0 | 4.8 | 5.6 | 6.4 | 7.2 |
| Multipliers for cu. ft. air (6 change per hr.) | 3.6 | 4.8 | 6.0 | 7.2 | 8.4 | 9.6 | 10.8 |
| Multipliers for double windows | 16 | 21 | 26 | 31 | 36 | 41 | 46 |
| Multipliers for frame construction, poor | 20 | 26 | 32 | 38 | 44 | 50 | 56 |
| Multipliers for frame construction, best | 10 | 13 | 16 | 19 | 22 | 25 | 28 |
| Multipliers for ceiling close to roof | 10 | 13 | 16 | 19 | 22 | 25 | 28 |
| Multipliers for ceiling with large air space | 3.8 | 5 | 6.3 | 7.6 | 9 | 10.3 | 11.5 |

### STEAM PRESSURE.

I see by the letters of J. H. Rogers and Jas. Swanson, in our November issue of The Power House, that this cylinder-stud-stress question is not only growing, but is going to prove beneficial. As I see the discussion now, we are all unanimous in saying that the stud must and does carry the strain of the pressure between the cylinder cover and cylinder end, plus the strain of internal steam pressure. Now that is what I said in my letter, and both Rogers and Swanson argue the same thing; but the difference of opinion comes in regarding the elasticity of the studs allowing the pressure between the cover and cylinder end to be reduced as they (the studs) stretch.

The question as it now stands, is, "Does the pressure of the steam against the inside of a cylinder cover lessen the pressure with which the studs hold the cover against the cylinder end?"

So the original question has been settled, and now we face this new one. Now I am in this discussion to learn, and I want to say before I go any farther that the engineer who has passed the learning stage is a dangerous man. I may be wrong in assuming that the internal steam pressure does not lessen the joint pressure and if I am wrong I want to be put right. I do not know exactly what the elongation of a ¾-in. stud 1½ in. long would be when subjected to a 2,000 lbs. strain, but I have always put it down for practically nothing. One of the things that has held me to that belief is this thought. If a cylinder cover were put on with a ground joint and under pressure, the studs elongated "a little," would not the joint open a like amount and leak? And then if the cover and cylinder end had been, by the stud-stress, slightly compressed, and as the studs elongated under steam pressure, the surfaces expanded to meet each other and keep the joint tight, then the pressure between cover and cylinder end are kept up.

Now, on page 43, I see a question by "Subscriber," asking for the steam pressure necessary to blow out through two series-set safety valves, each weighted for 120 lbs. The answer has been given as 120 lbs., and I must, until proven wrong, say 240 lbs. Let us imagine the arrangement in practice. We raise 120 lbs. on the boiler, the bottom valves raise and lets say 1 lb. into the space between the valves, then it shuts, for there is only 119 lbs. tending to open it. When steam raises to 121 lbs. it will blow again and raise pressure in space between valves to 2 lbs., and then shut, and so on this operation is repeated till there is 120 lbs. pressure between valves and 240 lbs. pressure in the boiler. Then both valves will begin to blow together, and as one valve. It is the same question as would be if the weights for two 120-lb. valves were placed on the lever of one valve, only in "Subscriber's" case the added pressure to the top side of the disc of bot-

tom valve is applied by steam pressure, instead of by spindle pressure. In other words, the steam enclosed between the two valves is as a spindle reaching from the bottom of the top disc to the top of the bottom disc, and transmitting the force of the top weight and lever to the the bottom disc.

R. MANLY ORR.

## ZINC AS PREVENTIVE OF CORROSION.

Geo. Burniston, in the November number, asks if any engineer has proof that zinc plates have really done any good in a boiler.

If he will look up the proceedings of the Inst. M. E. of August, '84, he will find that "The investigations of the committee on boilers served to show that the internal corrosion of boilers is greatly due to the combined action of air and sea water when under steam, and when not under steam to the combined action of air and moisture upon the unprotected surfaces of the metal.

There are other deleterious influences at work, such as the corrosive action of fatty acids, the galvanic action of copper and brass and the inequalities of temperature.

Of the several methods recommended for protecting the internal surfaces the three found most effectual are : First, the formation of a thin layer of hard scale, deposited by working the boiler with sea-water ; second, the coating of the surfaces with a thin wash of Portland cement ; third, the use of zinc slabs suspended in the water and steam spaces."

And he will find that in the British service the use of zinc properly distributed and fixed has been found the most effectual in saving the iron and steel surfaces from corrosion. The action of zinc in preventing corrosion appears to be an electrical one.

In the following list of metals :

| | |
|---|---|
| 1. Zinc | 7. Bismuth |
| 2. Cadmium | 8. Antimony |
| 3. Tin | 9. Copper |
| 4. Lead | 10. Silver |
| 5. Iron | 11. Gold |
| 6. Nickel | 12. Platinum |

13. Graphite

Any two constitute a voltaic couple when immersed in saline or acidulated water, and the first of the two is the positive element provided they are taken in the order in which they are written.

Zinc, it will be seen, is positive to all the others, therefore when zinc is placed in a boiler containing salt or acidulated water, a galvanic action is set up in which the zinc is used up instead of the iron. Zinc, however, is not an unmitigated blessing. A case is on record in which a tubular boiler was badly afflicted with scale composed of organic matter and lime. Zinc was tried with such success that its use was continued until the scale was removed. Later the water was obtained from another stream with the result that the tubes and shell were covered with a tough hard scale composed of zinc oxide and organic matter.

R. McLAREN.

## STEAM, WATER AND AIR PRESSURE.

I take the liberty of asking you for some information which I am anxious to obtain. What is the theoretical h.p. of different sized jets and pressures of steam, water and air, the diameter of the jets varying from 1-32 up to 16-32 of an inch or more and the pressure from ten to two hundred pounds per square inch, also can you give me the address and name of a book or pamphlet, which contains printed tables giving this information in detail.

READER.

## SAFETY VALVES.

On page 43 of the November issue of The Power House a request for information in regard to safety valves appeared, the question being sent in by one of our subscribers. The request for information read as follows :

"I would be glad to receive through The Power House an answer to the following question. If an engineer had two safety valves both set to blow at 120 pounds and put one on the discharge of the other, what pressure would need to be on the boiler to make the top one blow ? You will probably think this a foolish question, but I understand it is a state license law in the United States and we have had quite an argument over it."

Unfortunately a wrong interpretation was put on the question, and the proper answer to the question should be 240 lbs. A simple experiment to prove this result would be to fasten a safety valve set at 50 lbs. on the exhaust of another set at 50 lbs., use hydraulic pressure and note the result. This gives a practical demonstration of the correctness of the above answer, 240 lbs., for the second safety valve will register approximately 100 lbs. in the hydraulic test.

We refer the readers to the letters of R. Manly Orr, Carington C. Coriss and O. P. St. John, which give the correct answers to the problem.—Editor.

I notice on page 43 of the November number of The Power House a catch question on safety valves, as follows :

"If an engineer had two safety valves, both set to blow at 120 lbs., and put one on the discharge pipe of the other, what pressure would need to be on the boiler to make the top one blow ?"

To which you reply, "The first safety valve blows at 120 lbs., as soon as the temperature equalizes, the second safety valve opens at 120 lbs., though not simultaneously with the first, the difference in time depends on the length of pipe, radiation, etc."

Now nothing awakens the interest of engineers more than a good discussion, therefore out of "sheer contrariness" I am going to dispute your answer, and start the ball rolling.

Let us suppose that a boiler is fitted with an ordinary ball and lever safety valve, set to open at 120 lbs. per square inch gauge pressure. We will assume that the discharge pipe of this valve is six feet long, and open to the atmosphere. To simplify matters, we will assume the valve to be frictionless, and will disregard the difference in area between the upper and lower surfaces of the valve, due to the "lip" or cover, also the effects of condensation, radiation, etc., which would complicate, without materially affecting the question.

We will assume the effective weight of the valve and lever as being equal to a pressure of 3 lbs. per square inch on the valve. That is, it would require 3 lbs. pressure in the boiler to open the valve without any ball on the lever.

Suppose that to the open end of the discharge pipe we attach an air pump and exhaust the air, creating a perfect vacuum in the pipe. At what pressure would the valve then open ? Manifestly at 120—15 lbs. or 105 lbs. Why ? Because we have relieved the upper surface of the valve of the atmospheric pressure of 14.7 lbs. (say 15 lbs.) per square inch.

Instead of attaching an air pump to the discharge pipe, and exhausting the air, suppose that we attach the hose from an air compressor, and fill the pipe with air to a pressure of 10 lbs. per square inch above the atmosphere. At what pressure will the valve open now ? The 10 lbs. above the valve will balance an equal pressure below the valve, and the ball remaining constant, it will require 120 plus 10, or 130 lbs. to raise the valve. Similarly, if we filled the chamber formed by the discharge pipe with air at 50 lbs. pressure, it would require a pressure on the boiler of 120 plus 50, or 170 lbs. to open the valve.

If instead of attaching an air compressor to the free end of the discharge pipe, we attach another safety valve of the same size, and set to open at the same pressure as the first one, at what pressure in the boiler will the second valve open ?

The pressure in the boiler rising to 120 lbs. the first valve opens and allows the steam to enter the chamber formed by the pipe between the first and second valves. As soon as the pressure in this chamber has risen slightly, say to 5 lbs., the first valve will close, and, assuming the pressure in the pipe to remain constant, will remain closed until the pressure in the boiler has risen to 120 plus 5 lbs., or 130 lbs., when the valve will open again and admit more steam to the chamber. This operation will be repeated until the pressure in the boiler has risen to 120 plus 120 lbs., or 240 lbs., when the outer valve will open.

To illustrate this more clearly, let us suppose that the second valve is set to open at a slightly higher pressure than the first one, say 121 lbs. gauge pressure. The pressure in the boiler having risen to 120 lbs., raise the lever of first valve and allow the pressure in the boiler and chamber to equalize, then remove the ball from the lever, now lift the lever and release it, the valve being in equilibrium, the weight of the valve and lever will close the valve and, as the effective weight of the valve and lever alone is equal to 3 lbs per square inch, it will require 123 lbs. pressure on the boiler to open the valve.

If you take hold of the lever at this time you will find that a very slight effort is required to lift the valve, it being, as I have said, in equilibrium. Now replace the ball on the lever and try to lift the valve, you will find that it will require just as much effort to lift it as if there was no steam pressure on the boiler or discharge pipe. Why? Because while the valve is in equilibrium, the ball is not, its weight remaining constant.

The same effort, therefore, which you would have to make to lift the valve will have to be made by the steam, and as we know that would be equal to 120 lbs. pressure on the valve, which added to the 120 lbs. already in the discharge pipe, would equal, approximately, 240 lbs. pressure on the boiler, before the second valve would open. Q.E.D.

Theoretically, I believe this to be correct. What would occur in actual practice would depend largely upon the relative capacity of the two valves, the size of the chamber between the valves, and other conditions which might affect the working of the valves.

O. P. ST. JOHN.

---

The answer to the safety valve problem is 240 lbs. As soon as the first valve next to the boiler would start to relieve, the pressure would accumulate between the two valves and close the one next the boiler. There would then be 120 lbs. between the two valves, and 120 lbs. in the boiler. It would then require another 120 lbs. before the second valve would relieve. A good experiment is to try it with water. Do not try it with steam.

PAT. LAVELLE.

---

I fear that the discussion on cylinder bolts is taking up more space than you can well afford, but trust you will allow me a few words in reply to Mr. Rogers.

The stress on the body of the bolt is the subject under consideration. In my sketch I represented the steam pressure by a weight hung from the head of the bolt. The pressure comes on the body of the bolt just the same no matter whether the weight is hung above or below the head of the bolt.

For example, imagine a man hanging by his hands from a bar. A weight is then attached to his feet. It makes no difference to the stress on the man's arms and body whether that weight is hung from a ring around his ankles or from eyebolts screwed into the heels of his boots. Similarly in my sketch it makes no difference to the stress in the body of the bolt whether the weight is hung from an eyebolt screwed into the head of the bolt, or from a ring encircling the neck of the bolt.

However, the sketch given by Mr. Carruthers is much clearer than my own, and brings out well the point under discussion. It may readily be tried by substituting weights for the steam pressure. Tighten up the spring balance to some stated pressure. It will then be found by adding weights on the bottom cylinder head that the spring balance will not show any increase in tension until the combined weight of the lower head and added weights exceeds the initial tension on the spring balance. Which is what Mr. Jones claimed in his opening letter.

The same principle applied to other instances may help to make the matter a little plainer.

A pop valve spring, as suggested by Mr. Carruthers, is given sufficient initial compression to balance a pressure of 100 lbs. per square inch. If the increased tension theory were correct, the tension would increase the minute any pressure was applied, and the valve would blow at almost no pressure. But we find in practice that the boiler pressure rises until the internal pressure exceeds the initial pressure on the spring; proving that there is no more stress on the spring as the pressure rises until the internal pressure exceeds 100 lbs. per sq. inch.

Another instance of initial stress is given by the spring in a centrifugal governor. This spring is given considerable tension, holding the governor weight in on the inner stop in the governor wheel. This governor weight remains at rest on the stop as the engine runs up to speed, until the centrifugal force of the weight exceeds the spring force. As soon as this occurs the weight commences to move out. If the increased tension theory were correct this weight would commence to move out the moment the engine started, for the increased tension would cause the spring to lengthen and allow the weight to move. But it doesn't move, for anyone who has had anything to do with balancing a governor knows that the hammering of an unbalanced weight commences as the engine nears her normal speed, showing that the weight remains on the stop until that time.

If the steam pressure produces an increase in tension, it also produces an increase in length; which is equivalent to saying that all ground joints leak when the pressure comes on them. But they don't.

The fundamental error is that most people think that the tension on the bolt and the pressure of the steam act in the same direction, whereas in reality they are opposing forces acting in opposite directions—the initial tension holding the cylinder head on, and the steam trying to lift it off. When steam is admitted the pressure of the steam is substituted for the reaction of the cylinder head, that is all.

Mr. Roger's third sketch illustrates the matter very clearly. Until the spring pressure inside the cylinder exceeds the spring pressure outside, there will be no increase of compression on the outside springs, and no increase of tension on the bolts; which is the same as saying that there is no increase of tension in the cylinder head bolts until the steam pressure exceeds the initial tension.

In Mr. Rogers fourth sketch he introduces another force which does not exist in the case of the cylinder head. In my sketch I represented the steam pressure by a weight hung on the bolt and the initial tension by the stretch of a spiral spring. No other force was mentioned or understood except the reaction of the cylinder end. To make the tug-of-war case similar to the steam pressure case, I would suggest a man pulling 200 lbs. on a rope attached to a hook. Along comes another man, slips the rope off the hook and pulls on it himself 200 lbs. The tension on the rope is still the same, but the pull of the other man is substituted for the reaction of the hook. Similarly in the case of the cylinder bolt, the pressure of the steam is substituted for the reaction of the cylinder end.

In reference to a question from "Subscriber" about putting one safety-valve on the discharge of the other, if both safety valves were side by side on the same pipe, they would act as stated, but

"Subscriber" intends the discharge from the first valve to attempt to lift the valve of the second, or top, safety valve. If both valves were set at 120 lbs. when acting singly, it would take 240 lbs. to lift them when piped in tandem, as the back pressure of 120 lbs. from the top valve, would hold the second valve down on its seat until 240 lbs. had accumulated in the boiler. In fact, the whole arrangement looks like a short cut to heaven.

C. C. CARISS.

## NIAGARA POWER.

How much is the estimated h.p. of Niagara Falls? How much h.p. is used on the Canadian side and how much on the U. S. side?

ALEX. D. TRUSSLER.

Prof. R. W. Angus gives the estimated h.p. of Niagara at 5,000,000 h.p. Charters have been granted for the development at the Falls of 705,000 h.p. The accompanying table gives the amount of electrical energy generated for export and consumption in Canada for the fiscal year ending March 31, 1909; also the approximate generating capacity at that date of the Canadian companies. We have not the figures of the U. S. companies at hand, but would appreciate it if a reader would send it to us. See the reference to Niagara Falls on page 28.—Editor.

| Name of Company | Generating Capacity in k.w.h. | Total Amt. Generated in k.w.h. | Generated for export in k.w.h. | Gen. for Canadian Consumption in k.w.h. |
|---|---|---|---|---|
| Canadian Niagara Power Co. | 300,000,000 | 227,333,000 | 221,927,240 | 5,405,760 |
| Electrical Devel. Co. of Ontario | 300,000,000 | 90,195,000 | 4,680,500 | 85,515,400 |
| Ontario Power Co. of Niagara Falls | 450,000,000 | 175,084,362 | 131,833,784 | 44,150,580 |

## DR. HAANEL'S REPORT SHOWS PREPARED PEAT FUEL ADAPTED FOR PRODUCTION OF GAS.

Dr. Haanel points out that, while eastern and western Canada have immense coal areas, the middle provinces are practically dependent on the United States for all fuel for domestic and industrial purposes. The value of the anthracite coal alone imported annually is now over $10,000,000. But while coal is absent from the middle provinces, there is peat in abundance, over 37,000 square miles of peat bogs having already been located by the government surveyors. The report notes that one square mile of bog, with an average depth of six feet, will, after drainage, yield 774,000 tons of air-dried peat, equal in fuel value to 420,244 tons of ordinary bituminous coal. The utilization of this fuel asset is, therefore, manifestly of supreme commercial importance.

With a view to utilizing the potential heat energy lying dormant in the Ontario and Quebec peat bogs, the Dominion government, through the mines branch, has during the past couple of years made a complete investigation of the peat fuel industries of Europe, and has tested large areas of Canadian peat bog. Recently with a view to doing for the peat fuel manufacturer what the Department of the Interior has done for the farmer, the government has purchased an extensive peat bog at Alfred, near Caledonia Springs, Ont., and has established a modern fuel-testing plant at Ottawa for experimental purposes. The chief object of this plant will be to practically demonstrate the feasibility of utilizing peat in the gas producer and gas engine for the generation of power.

The peat bog at Alfred covers approximately 300 acres, has an average depth of eight to nine feet, and is a fair sample of many of the peat bogs in Canada. During the past summer the bog has been levelled and sampled, and about five miles of ditches have been dug for the purposes of drainage. The peat in the bog contains on an average some 85 per cent. of moisture which is reduced by the drying process in the Ottawa plant to about 25 per cent. In this condition the peat bricks are admirably adapted for the gas producer as well as for domestic purposes. The plant when in full running order will have a daily output of about thirty tons, and the operating methods and machinery employed are similar to those now in use in many commercial plants in Europe. The estimated cost of one ton of air-dried peat at the bog will be about $1.75. This price, together with the cost of transportation for short distances, will make the total cost of peat—having a fuel value equivalent to good coal—considerably lower than that of coal—

In the utilization of peat fuel in the gas producer for power purposes Dr. Haanel does not recommend that the fuel be transported for long distances to power stations, but that power plants be erected on the bogs to convert the potential energies stored in the peat into electrical energy for distribution to neighboring towns, as is now done in Germany. In this way a peat bog will become a source of energy precisely as in the case of a water power.

James Milne, M. Can. Soc. C.E., M. Am. Soc. M.E., has resumed his consulting practice, and now has an office in the Loo Building, Vancouver, B.C. Mr. Milne has had many years' experience in connection with the development of power, the construction, maintenance, and operation of electric railways and other municipal problems. He will handle work related to electrical, steam and mechanical engineering from the preparation of plans and estimates to the supervision of construction and operation.

## C.A.S.E. PRESIDENT'S GREETINGS TO ENGINEERS.

Chatham, Dec., 1909.

To the Officers and Members of Subordinate Association.

Greetings:

Brothers,—Again I thank you all for the honors conferred upon me in electing me for the second term as your president. I assure you I appreciate it very much, and will do all within my power for the best interests of the Canadian Association of Stationary Engineers. I may say that a lot of good work has already been done by your executive this year. Still there is more to do, and I ask the earnest co-operation of all members in this great work.

Strive to increase our membership. See that a new association is formed in that nearby city or town. We would like to see a number of new associations formed this year. And this can best be done by earnest work on the part of all.

I again call your attention to the Question Box. See that a number of questions are in it for every meeting as this is a great source of education and that is what we are banded together for. Make all our meetings as entertaining as possible, and I assure you that success will crown our efforts.

Brothers, the year 1909 is just closing and I trust we can all look back with pleasure on the good work done. And when the old year passes away and a new one makes its appearance, we will all be happy in Greetings of Merry Christmas and Happy New Year.

Thanking you all again for the courtesies extended to me and wishing all a Merry Xmas and Happy New Year, and remain,

Fraternally yours,

CHAS. KELLEY,
President C. A. S. E.
83 Adelaide St. South,
Chatham, Ont.

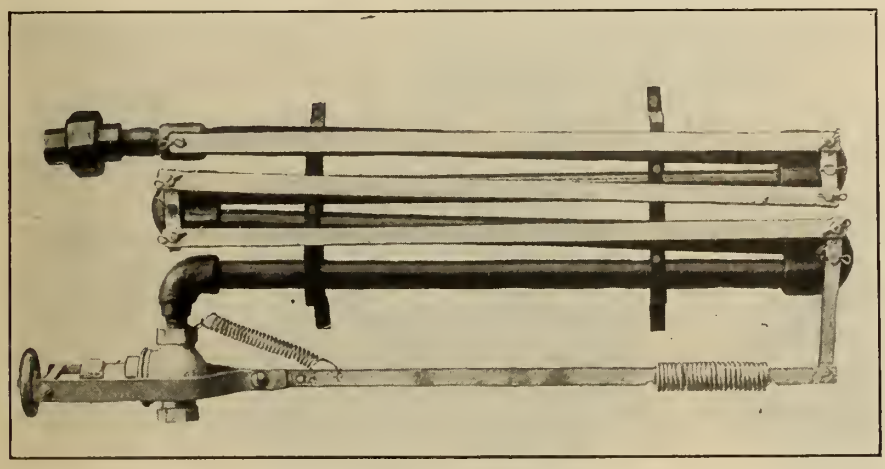
# NEW EQUIPMENT *for* POWER PLANTS

To Have a Place in this Department the Machine or Appliance Must Have New and Interesting Features — No Write-Ups Can be Used.

### DUFFY STEAM TRAP.

The distinctive and controlling feature of the Duffy Trap, shown in the illustration, lies in the expansion and contraction of ordinary iron pipe in coil. The return bends connecting adjacent ends of these pipes are provided with projecting bosses, the bosses are further provided with a pivot to support levers, the first rod or link having one end fixed to inlet end of trap, the other end being connected to first lever, which, together with a plurality of rods, connect the other levers in series directly with the outlet valve, the whole system forming an oscillating chain of rods and levers from inlet union to outlet valve, and as these rods do not expand, the slightest expansion in the trap pipes will cause the rods and levers to rock and close valve. The reverse motion (contraction) will open outlet valve, which will continue to open and close with varying amount of condensation coming from steam system. Immediately on steam entering the first length of pipe expansion occurs, and the closing of the outlet valve begins; when steam has reached the second length of pipe the outlet valve is entirely closed, and remains closed until condensation begins to accumulate in first and second lengths of pipe, thereby causing these lengths to contract and permitting the outlet valve to open gradually, and also to remain open so long as the condensation flows into first and second pipes. The third and fourth pipes being full of water, renders it simply impossible for live steam to pass through the water in these pipes, more especially as the water is confined in such a small space, thus forming a perfect seal against rushes of live steam at the discharge valve, and ensuring perfect continuity and uniformity in working, with the utmost possible economy of fuel.

The Duffy trap is manufactured by Francis Duffy, 136 Stewart St., Kingston. It is patented in European countries, and United States as well as Canada.



Duffy Steam Trap.

### THE "Z" TUNGSTEN LAMP.

The efficiency of the tungsten filament lamp is bringing it rapidly into favor as a means of lighting. One of the most recent lamps placed on the Canadian market is the "Z," manufactured by the "Z" Electric Light Mfg. Co., and imported into Canada by Chapman & Walker, corner Victoria and Lombard Sts., Toronto. The lamp received its name from the fact that two of the inventions were made by Zerning, and the fact that zirconium is used in the process of manufacture. The filaments in their finished state, however, are almost pure tungsten.

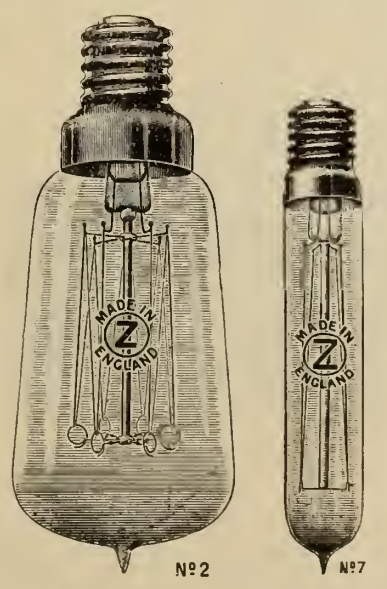



Fig. 1.—Ordinary. Fig. 2.—Special.

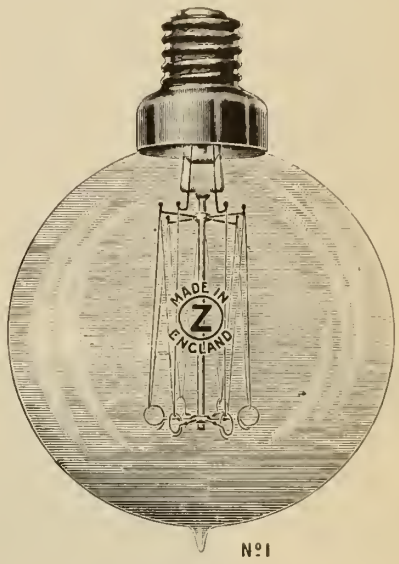



Fig. 3.—Globe.

The "Z" lamp, like the majority of other tungsten lamps, is of the multiple filament pattern, and its filaments are of the hairpin shape, grouped around a central glass support and connected in series. At the pip end, the filaments are supported by carbon hooks attached to the centre stem by thin steel wires. The combination of steel wire and carbon hook forms a spring support which compensates for the expansion and contraction of the filament, and at the same time eliminates the vibration. Fig. 1 illustrates the ordinary lamp and shows the position of these loops. Figs. 2 and 3 show a special and the globe form of the lamp. The centre stem is a glass rod, to which are attached the steel wires mentioned above, and the usual nickel supporting wires for the other end of the filament. The centre stem is attached to the foot of the lamp, which contains the leading-in wires, to which the filaments are welded. A special salt, which prevents blacking of the lamp, is painted on the centre stem.

One of the most interesting operations in the manufacture of "Z" tungsten lamps is that of exhausting. Two types of pumps are employed, the large "Berrenberg" pump and the rotary mercury pumps. The use of the "Berrenberg" pump is particularly mentioned, as a mechanical pump is not employed by

many (if any) other manufacturers, in exhausting metal filament lamps. On this pump some two or three hundred lamps can be exhausted simultaneously, instead of ten or twelve with the ordinary rotary mercury pump. As a result of several improvements which have been introduced into the "Berrenberg" pump, a vacuum is now produced as high as with the ordinary forms of mercury pumps, and without sacrificing the high working speed due to the great capacity of the "Berrenberg" pump already referred to. During the pumping stage the lamps are subjected to great external heat, and at the same time are considerably over-run. The use of the special chemical on the stem prevents any blackening at this stage, as well as during the life of the lamp.

After pumping, the lamps are tested on a screen for from one to two hours, where they are kept under observation both at their normal voltage and over-run. The vacuum is tested by the spark method, both during and after the pumping, and the greatest care is taken to ensure that the highest vacuum possible is obtained. Throughout both the exhausting and screening operations, the amount of over-running is carefully controlled. Auto-transformers are used on the benches to avoid excessive losses in resistance, and voltmeters are provided, so that the temperature of the filament is not left to be determined merely by the eye of the operator.

The lamp is made to suit voltage as follows:

| | |
|---|---|
| 25 volts ... ... ... | 8 to 20 c.p. |
| 50 volts ... ... ... | 10 to 25 c.p. |
| 100-130 volts ... ... ... | 16 to 18 c.p. |
| 100-130 volts ... ... ... | 20 to 50 c.p. |
| 130-160 volts ... ... ... | 30 to 60 c.p. |
| 200-250 volts ... ... ... | 40 to 50 c.p. |

## SOME NEW STEAM SPECIALTIES.

Sheldons Ltd., Galt, Ont., have redesigned their back pressure valves illustrated herewith. Fig. 1 shows the interior and Fig. 2 the exterior of class A back pressure valve. It is a double-seated valve for use in connection with non-condensing engines, vacuum or direct systems of steam heating. It must not be used with condensing engines. It can be used in any position, but it is recommended that it be used in a horizontal position with cover on top.

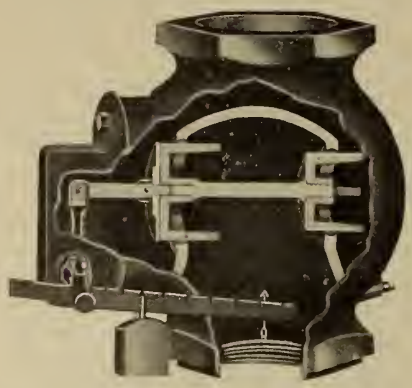


Fig. 1—Class A Back Pressure Valve.

The piston has discs of different area, the total of which is approximately equal to the full area of the pipe. This construction allows one disc to practically balance the other, which eliminates the necessity of heavily weighting the value against the pressure retained. The cover can be shifted to any position.

Fig. 2.—Class A Back Pressure Valve.

When these valves are to be used on steam heating systems at or below atmospheric pressure, the discs may be bevel seated and ground, and the valve provided with a counter-balance lever to permit of closer adjustment.

Class B exhaust relief valve is designed for condensing or non-condensing plants. Fig. 3 shows the horizontal pattern, Fig. 4 a section of horizontal pattern and Fig. 5 the vertical pattern. On condensing plants it is necessary to have a complete vacuum, which can only be realized by using a single seated water sealed valve, while on a non-condensing plant a two-seated balanced valve is used.

The class B valve can be used for a non-condensing plant, or, by closing the controlling valve, it can be converted into a single seated valve for a condensing plant, the lower valve then acting as a dash-pot. For condensing plants, these valves are usually installed in a branch leading from the main exhaust pipe. When the engine is started and a vacuum obtained in the condenser, the atmospheric pressure on top of the seat closes the valve and keeps it closed as long as a vacuum is maintained, but if the air pump fails, the injection of water stops, or for any other reason the vacuum is lost, the exhaust pressure becomes greater than the atmospheric and causes the valve to open immediately, allowing the engine to exhaust to the atmosphere, and also does away with the necessity of stopping the engine.

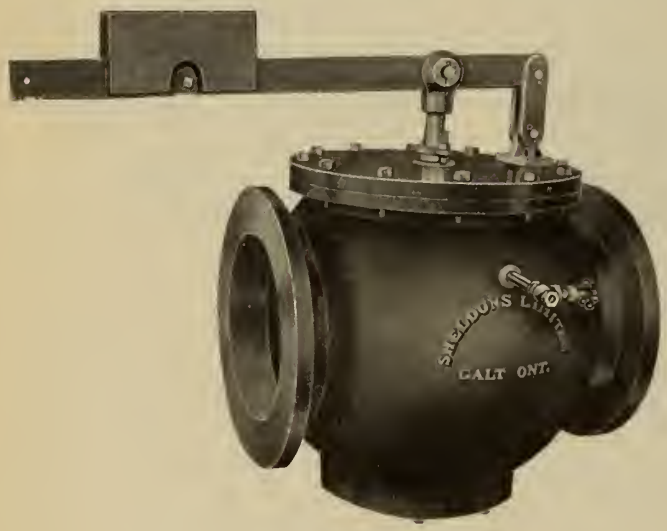



Fig. 3.—Class B Exhaust Relief Valve.

Fig. 4—Horizontal Pattern Class B Exhaust Relief Valve.

Class B valves have full pipe opening and allow the steam to exhaust through them freely. Both vertical and horizontal patterns are furnished with dash-pots. The dash-pots allow the valves to open and close noiselessly and pre-

vent the discs from hammering and injuring the seats. The valve seats are made from a bronze ring and the discs

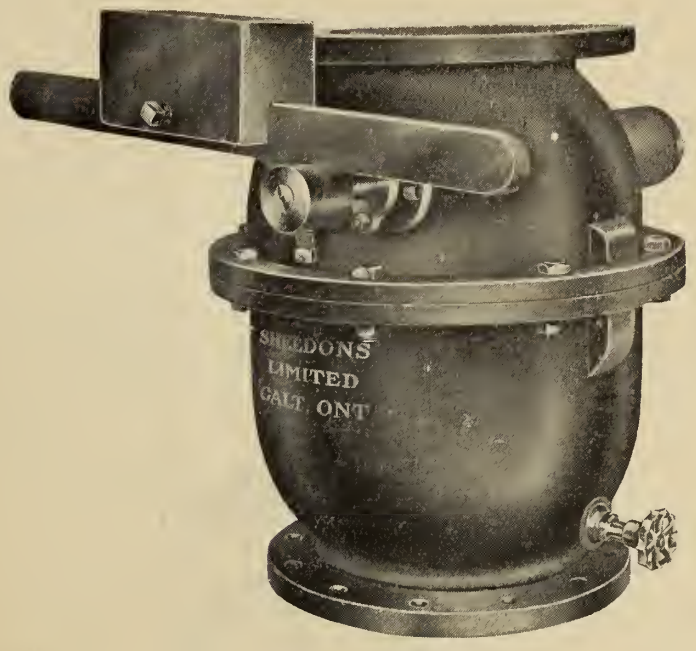



Fig. 5.—Vertical Pattern Exhaust Relief Valve.

are faced with a babbitt metal, which construction enables them to hold tight under high vacuums and not to adhere to each other when pressure comes on the valve.

---

## IMPROVED CALIBRATING APPARATUS FOR HYDRAULIC AND OTHER HIGH PRESSURE GAUGES.

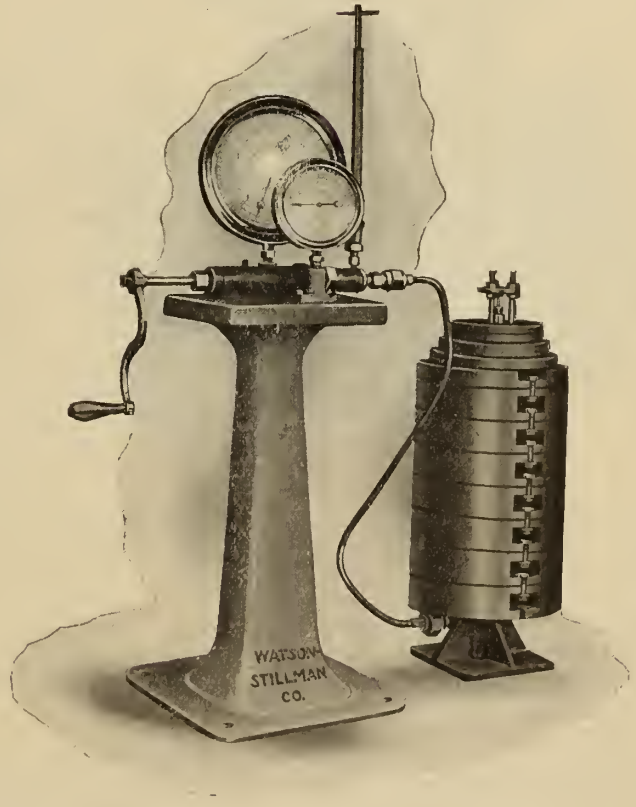
The bursting of machine parts and fittings from excessive fluid pressure is usually accompanied by considerable danger, expense and delays for repairs. This is especially true with the extremely high working pressures under which liquids and air are often used. It is therefore quite important to know the pressure conditions within any apparatus using these sources of power, and for this reason the gauges should be calibrated at regular intervals. Under the higher hydraulic pressures, it is frequently the case that the same gauge will show different percentages of error at different pressure readings, and these can be compensated for in ascertaining the true pressure only by comparing with a "master" gauge of known accuracy or by loading with a known pressure.

The outfit which we illustrate performs these two functions of testing by comparison with a master gauge and of testing the accuracy of the master.

For the first, only the part on top of the stand is required. This consists primarily of a cross made of hydraulic bronze. The gauge being tested, which may register any pressures up to 16,000 pounds per square inch, and the master, are attached to the front and back ends of the cross respectively. At the left is a crank-operated screw displacement piston, by means of which the desired pressure may be produced within the pressure chamber. A suitable stuffing box prevents leakage past the piston. To the right end is connected a stop valve and filling cylinder. This permits (1) some of the liquid to be withdrawn from the pressure chamber before removing the gauge being tested and (2) filling after a gauge is put on. There is thus no danger of spilling the oil.

For testing the master gauge, the special weight-loaded hardened and ground steel piston and cylinder are attached at the right by means of flexible copper tubing, as shown. These parts are cut out by a stop valve when not testing the master. The cylinder is long enough to have the centre of gravity of the weight below the centre of support. When the weights are revolved the friction due to lifting the weights is practically eliminated.

The apparatus is made by the Watson-Stillman Co., New York.




Improved Calibrating Apparatus.

---

It is customary in Europe to place a netting under high-tension lines at railroads and important street crossings. As a further protection at such points, an inventor has recently devised a safety suspension in which the line is divided into three parts at the crossings and supported on three insulators, any one of which will bear the entire weight of the line at that point in case the others should be fused or broken. The German Post Office Department has approved of this system, and permits its use at crossings.

## GOLDEN CUSHIONED TRIPLE ACTING AND NON-RETURN VALVES.

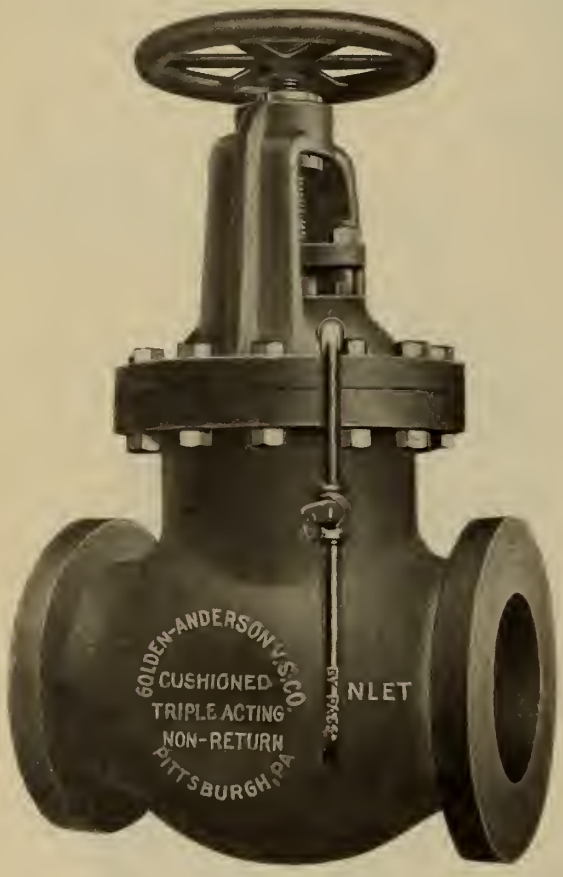
The Golden Cushioned Non-Return Valve shown in Fig. 1 is designed to be an automatic non-return, an automatic safety stop, an automatic emergency stop and a hand stop valve, all in one. The following features are claimed by the manufacturers for it:—It automatically protects the boilers in case of accident, such as the bursting of a tube, and will act as a safety stop to prevent steam from being turned into a cold boiler, which means a safeguard for men working inside of them. It protects life and property in case a break or rupture occurs in the main steam line or branches. The valves will automatically cut off the flow of steam from the boilers until the break is repaired. It can be used as "Steam Closing" stop valves operated from the floor or from different parts of the plant by hand, independent of the pilot valves. It may be closed same as ordinary valves.

The Corliss dash pot method of cushioning these valves is employed, occupying the full area of the upper portion of the body, insuring a positive cushion in the opening and closing of the valves and the alignment with the seat at all times.

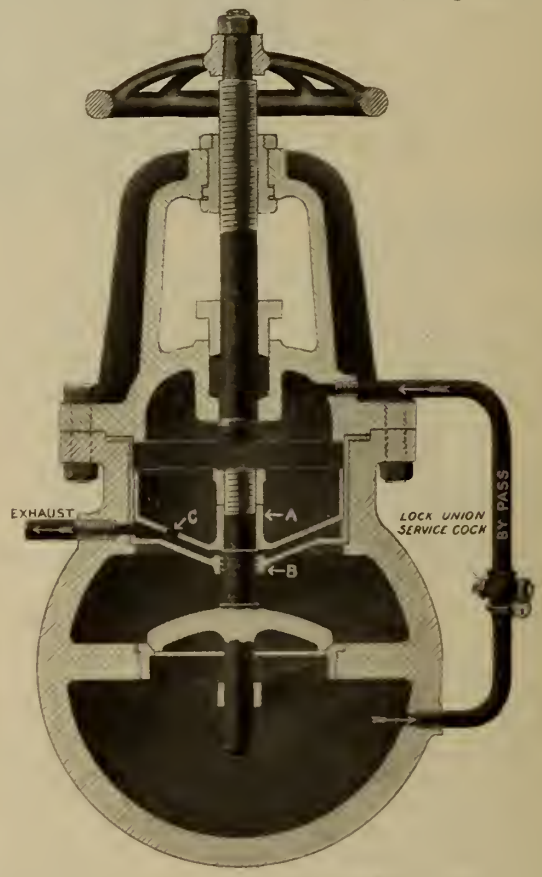
The sectional view, Fig. 2, shows the inside dash-pot "A" attached to the valve spindle, while the outside dash-pot "B" acts as a bronze cylinder, which is held firmly in place by the bolted valve top. It also shows the by-pass which admits full boiler pressure above and underneath the inside dash-pot at "C," therefore it is balanced. The steam connection from the main steam line to the automatic pilot valve holds it closed because of the larger area above its valve.

There is also an exhaust pipe connection between the two dash-pots leading to the pilot valve. In case a rupture occurs in the steam lines, the pressure is removed from the top of pilot valve, allowing it to instantly open, exhausting the pressure from between the two dash-pots of the triple valve. The full boiler pressure always being above dash-pot "A," the valve will close, at the same time is cushioned in the operation.

These valves are manufactured by the Golden-Anderson Co., Fulton Bldg., Pittsburg, Pa.




Golden Cushioned Triple Acting Valve.




Section of Golden Cushioned Triple Acting Valve

---

## DEATH OF J. C. WILSON.

J. C. Wilson, of J. C. Wilson & Co., mechanical enginers, Glenora, Ont., died at Picton, Ont., on Friday, the 12th of November, after an illness of some months. He was the son of the late Stewart Wilson, who came to Canada from Albany, N.Y., in the early part of the nineteenth century. On Mr. Wilson's arrival in Picton, he established the first foundry in Upper Canada, then known as the Phenix foundry, where the first plowshare was cast in Upper Canada. Mr. James Canniff Wilson was born in 1833, and on reaching the age of thirteen years his father purchased for him the property then known as "Stone Mills," some five miles east of Picton, on the shore of the Bay of Quinte, now known as Glenora, which comprised at that time a saw mill, grist mill, and woolen mill. The grist mill was operated by Sir John A. Macdonald's father for two years before Mr. Wilson got control. Even although young Wilson was only thirteen years of age when he first entered business he made a success of the venture. During the summer he operated the mills and in the winter months was a scholar at the McMullen Academy. The mills were burned about forty years ago and were rebult on a larger scale. In 1873 Mr. Wilson branched out into the manufacture of turbine water wheels and mill machinery, and built up a large and flourishing trade, a good part of the product being disposed of through a London, Eng., agency. Mr. Wilson conducted this business until seven years ago when he was succeeded by his son, Mr. F. S. Wilson, who now continues the business in the old firm name of J. C. Wilson & Company.

# THE POWER HOUSE

A monthly newspaper devoted to the Generation, Transmission and Application of Steam, Gas, Electric, Air and Water Power and to the operation of Refrigerating Machinery.

ISSUED THE SECOND WEDNESDAY OF EACH MONTH BY

**The MacLean Publishing Co., Limited**

*JOHN BAYNE MACLEAN, President* *W. L. EDMONDS, Vice-President*
*H. V. TYRRELL, Toronto - - Business Manager.*
*G. C. KEITH, M.E., B.Sc., Toronto, Managing-Editor.*
*F. C. D. WILKES, B.Sc., - Montreal, Associate-Editor.*

OFFICES:

**CANADA**
MONTREAL, 701-702 Eastern Townships Bank Bldg. Phone Main 1255
TORONTO - 10 Front Street East Phone Main 2701
WINNIPEG, 511 Union Bank Bldg. Phone 3726
F. R. Munro
BRITISH COLUMBIA Vancouver H. Hodgson Room 11 Hartney Chambers

**GREAT BRITAIN**
LONDON - 88 Fleet Street, E.C. Phone Central 12960 J. Meredith McKim

**UNITED STATES**
NEW YORK - R. B. Huestis 1109-1111 Lawyers' Title, Insurance and Trust Building Phone 1111 Cortlandt

**PARIS**
FRANCE - John F. Jones & Co., 31bis, Faubourg Montmartre, Paris, France

**SWITZERLAND**
ZURICH - - Louis Wolf Orell Fussli & Co

Cable Address:
Macpubco, Toronto - Atsbek, London, Eng.

SUBSCRIPTION RATE:

Canada, United States, $1.00; Great Britain, Australia and other Colonies, 4s. 6d. per year; other Countries, $1.50. Advertising rates on request.

Subscribers who are not receiving their paper regularly, will confer a favor on us by letting us know. We should be notified at once of any change in address, giving both old and new.

Vol. II DECEMBER, 1909 No. 12


## CONTENTS


Plant Equipment of Cobalt Hydraulic Company - - - 21
What is the Real Meaning of Efficiency? - - - - 25
The Cost of Power - - - - 26
Why Refrigerating Plant Fails to Make Capacity - - - 27
Method of Calculating Horse Power 28
Properties of a Good Lubricant and Tests for Same - - - - 29
A 10,500 H.P. Impulse Water Wheel 31
Running Machines in Parallel - - 32
Society News - - - - - - 33
Modern Elevated Reinforced Concrete Coal Pockets - - - 34
Advance in Marine Engineering - 36
Practical Articles by our Readers - 37
Practical Articles
Locating Angle Belt Drives
Handy Table for the Solution of Right Angle Triangles
Formulae for Air Lift Pump
Value of Dry Steam
Setting the Eccentric of a Plain Slide-Valve Engine
An Inclined Hydraulic System
Brown Automatic Engine Emergency Repair
Emergency Repair to Pump Valve Gear
Emergency Repairs
Burning Ashes
Correspondence and Discussion on Previous Articles - - - - 41
Heating Surface
Steam Pressure
Zinc as Preventative of Corrosion
Steam, Water and Air Pressure
Safety Valves
Niagara Falls
Dr. Haanel's Report shows Peat Fuel adaptable to Production of Gas - 44
C. A. S. E. President's Greetings to Engineers - - - - - 44
New Equipment for Power Plants - 45
Duffy Steam Trap
The "Z" Tungsten Lamp
Some New Steam Specialties
Golden Cushioned Triple Action and Non-Return Valve
Power Plant Developments - - 50
Power Supply Markets - - - 52
Catalogues - - - - - - 53
Book Reviews - - - - - - 53


## BOILER SAFETY VALVES REQUIRE ATTENTION.

One of the explosions reported a few months ago in The Power House was, no doubt, due to a poor safety valve. From time to time we receive reports of explosions due to safety valves. Recently a locomotive boiler exploded in Cardiff, England, resulting in the death of three men and injuring three more. The locomotive had been built a year before for a working pressure of 160 lbs., and had twice been tested to 240 lbs., without producing any deflection, once with steam to 180 lbs., giving satisfactory results. As reported in The Engineer, of London, there were two Ramsbottom safety valves on a cast iron manhole cover. The joint leaked, and in remaking the joint it was necessary for the steamfitter to dismount the safety valves. The joint was made, the valves put back in place and a report made to the foreman. Next day the engine was taken out in the yards, and in a very short time the pressure gauge indicated 200 lbs., with the hand pressing hard against the stop. There was plenty of water in the gauge glasses, although the injectors had refused to work. Before long the gauge glasses broke and the engine was taken back to the shed. Two men began to drop the fire, and at this moment the boiler exploded.

The accident was commented upon by Power and the Engineer, showing that the boiler exploded by overpressure. From the facts that although the safety valves were loaded to begin lifting at 145 lbs. and blow hard at 155 lbs., they would not move; that the pressure was too high for the injectors to work and broke the gauge glasses, it is apparently conclusive evidence that the boiler exploded from over pressure, caused by the non-operation of the safety valves. To make this supposition more plausible, it is explained that all Ramsbottom valves are fitted with a safety link to prevent the valves and lever from being blown away if the spring breaks. Washers of various thickness are used to regulate the tension on the spring, and adjustment is always made to give the slot in the safety link ample clearance. It is only natural to suppose that the fitter, who was called away from the job several times, got confused about the washers and put the thick washer above instead of below on the central pin. This would lock the valve hard down on its side, and explains clearly the cause of sticking fast.

In American stationary practice there are no valves, to our knowledge, of similar make, in which by an exchange of washers it would be possible to lock the valve tight to its seat. It is easily possible, however, to have the same condition arise from various causes. In many plants the safety valve blows only at rare intervals. Such an occurrence is looked upon as waste of steam, and the result is, that the engineer is never positive of the valve opening at the pressure for which it is set. It is not an uncommon occurrence for a valve of the old lever type to stick fast to its seat either from corrosion or wedging, and even in the pop safety valve some defect might seriously interfere with its operation.

It is surely no great hardship, nor an extravagant waste of coal, to try the safety valve at least once a day. Raise the pressure to the point of blowing and note the gauge. The safe side is best, and a knowledge that all is right will repay the effort.

## THE INSURANCE ACT.

The Banking and Insurance Committee of the Senate, which has the new Dominion Insurance Act before it for amendment, has decided to postpone consideration of the Act until after New Year's.

Everyone who is interested in securing cheaper fire insurance should, therefore, take advantage of the delay to write letters to the local member of Parliament and the Senator from his district, urging upon them the necessity of refusing the demands of the insurance companies that they be given a monopoly of the insurance business in Canada. They aim to exclude all foreign unlicensed companies from doing business in this country. The manufacturers are up in arms against the combine and all interested should unite in defeating the effort to establish a monopoly.

# POWER PLANT DEVELOPMENTS

## News of Industrial Developments Requiring Steam, Gas, Electric, Air or Water Power Equipments—Municipal Power Undertakings.

### Electricity and Steam.

The Blindman River Electric Power Co. have sold their entire plant to the town of Lacombe, which will at once repair the dam on the Blindman river and install a steam auxiliary plant in the town limits. The council have secured the services of E. J. Tett as manager and engineer of the plant. Mr. Tett has for some years been secretary-treasurer and manager of the Blindman River Electric Power Co.

St. Lambert, Que., has decided to install an electric water pump to do away with the present steam pump, and to erect poles, wires, and apparatus for the electric lighting of the town, the current to be supplied by the L. E. Waterman fountain pen factory. A loan of $7,000 has been passed for the purpose. The action of the council is to pave the way for the town to own a complete power plant of its own.

A special committee dealing with the standardization of equipment reported to a recent meeting of engineers, representing the 12 municipalities in the Niagara Power Union, in favor of the adoption of a luminous arc lamp in business districts and a similar type of Tungsten incandescent lamp for use in the residential districts, the latter to be placed from 125 to 150 feet apart, to overcome any interference of trees.

After paying all running expenses, debenture interest, $5,303 and $7,597 on the debenture debt of the plant, the Brockville Light and Power Department, owned and controlled by the municipality, finished the past year's operations with a net surplus of $664. The department had a revenue of $51,915 from the sale of gas and electricity, and nearly $4,000 was allowed for depreciation.

The report of the three arbitrators appointed to appraise the value of the Stratford electric light plant has been received by the city authorities. The amount is fixed at $58,800, $43,800 for plant and $15,000 for good-will. The latter is based on the average yearly profit of $5,324. A by-law will be submitted to the ratepayers in January to raise this amount to purchase the plant.

Contracts have been awarded by the Hydro-Electric Commission in connection with the transmission lines, transformer stations and all mechanical equipment as follows: To Royce, Ltd., of Manchester, England, for electric cranes for the transformer stations at Ningara Falls and Dundas; for electric cranes for the transformer stations at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's Woodstock and St. Thomas, to Mussens, Ltd., of Montreal and Walkerville. Total amount of bids, $17,094.

The Port Arthur power propositions have been causing some excitement in that city. First the Ontario and Michigan Power Co. offered prices more advantageous than the Power Commission. For 3,000 h.p. the price was to be $18; for 4,000, $17; and for 5,000, $15. The Commission's prices submitted were $19, $18 and $17.60 for the same amounts. On a vote by the ratepayers on Nov. 4, the Hydro-Electric Commission's contract was endorsed. James Conmee, M. P., representing the O. & M. Co., applied for an injunction on the ground that the ratepayers had not been afforded opportunity to intelligently vote on the proposition. Justice Clute, sitting at Toronto, granted the injunction.

The Fraser River Lumber Co., at Fraser Mills, B.C., have recently placed a contract with the Allis-Chalmers-Bullock, through their Vancouver office, for a 750 k.w. steam turbo-generator, a 15 k.w. engine driven exciter set, also motor driven exciter set, together with a six panel blue Vermont marble switchboard. Individual motor drive is to be used for operating the planers, resaws, stickers, blowers, etc., in the sawmills for which they have ordered the following motors; one 150 h.p. induction motor; one 75 h.p. induction motor; seven 50 h.p. induction motors; twelve 40 h.p. induction motors; three 20 h.p. induction motors; two 10 h.p. induction motors, and two 5 h.p. induction motors. All the above motors are wound for 3-phase, 60 cycle, 440 volts.

---

### Trade Notes.

The Electrical Machinery Co., which is under the management of A. J. Phillips, assisted by James Watt, have removed to their new offices at 111 Simcoe St., Toronto. They will specialize on repairing and second hand electrical equipment.

The Soledad Mining & Milling Co., of Mexico, have installed complete mills for amalgamation and cyanidation, the machinery consisting of four Nissen Stamps, 1,500 lbs. each, machinery complete for regrinding, steam power plant, electrical equipment, the complete order being placed with Fairbanks-Morse & Co.

The Canadian Fairbanks Co., have been appointed the exclusive sales agents for Canada for Dicks' Balata Belting and have purchased the business of J. S. Young. All orders in the future should be sent direct to their nearest branch house. Large stocks will be carried at the present time at Montreal, Vancouver, St. John, N.B., Toronto and Winnipeg.

The Standard Engineering Co., 47 Wellington St., Toronto, have made arrangements with the Riblet Heater Co., Erie, Pa., for the handling of their Canadian business. Instalations of the Riblet Transverse Current Water Heater utilizing the exhaust from either steam or gas engine to heat water, will be made under the supervision of the Standard Engineering Co.

Harry D. Bayne, for many years manager of the Canadian Westinghouse, at Montreal, has acquired an interest in the Canadian end of the General Electric Co., of Sweden, which has been doing business in a limited way in the Dominion for some time, but an application will be made to Parliament for incorporation in Canada. Mr. Bayne will continue to make his headquarters in Montreal.

The contract for 50 miles of wire-bound wood pipe for South Vancouver, B.C., to cost $12,000 has been awarded to the Municipal Construction Co., Vancouver. The work on the construction of this pipe will start almost immediately, and the contractors expect to have the work all finished by June next year. About two-thirds of the total quantity of pipe is designed for a pressure of 400 feet head and the remainder for 300 feet head. This class of pipe has been used in the western provinces for these high heads, and the fact that it has proven itself under heavy pressure service should place it in favor with eastern engineers and councils. The Municipal Construction Co. have extensive works for the manufacture of the pipe at the corner of Arbutus Street and Thirteenth Avenue, Vancouver.

Conduits Co., have moved into their new factory at 126 Don Esplanade, Toronto. This factory is conveniently situated for shipping, being on the lines of the G.T.R., C.P.R., and C.N.R., while at the same time it is within easy reach of the business centre of Toronto. The factory is a solid white brick structure having a steel trussed roof with a clear span of 80 feet x 150 feet in length, giving ample space for the handling of their product. At the north end of the building a second storey has been added, 80 x 35 feet, the office and stores department being situated on this floor. Every convenience for the handling of the product has been installed with a view to improving the quality of the output. Many of the operations heretofore done by hand labor are now automatically performed, and chances of error are thereby eliminated. The power equipment consists of a 40 h.p. steam boiler and 52 h.p. a.c. motors.

---

### Company is Formed to Manufacture Ice.

A new company, under the name of The People's Ice Mfg. Co., has been organized with offices at 39 Scott Street, Toronto. J. P. Murray, of Toronto Carpet Mfg. Co.; D. C. Richard, broker and David A. Brown, of the People's Ice Co., Detroit, are back of the venture. A plant capable of producing one hundred and fifty tons a day will be established in the center of Toronto, and several properties are under consideration at present.

---

### Large Hydro-Electric Scheme.

The Canadian Light and Power Co., Montreal, has contracted with J. G. White & Co., New York, for the construction of a hydroelectric plant on the St. Lawrence river, near St. Timothee, Que. The plant will utilize the Beauharnois canal water, giving an available and constant head of 50 feet. The power station will contain three 7200-horsepower turbine units coupled to 4000-kilowatt generators and have space for a fourth unit; also two 400-horsepower exciter units and switchgear; the 27-mile transmission line to Montreal, and substation and distributing system at that city, will also be included in the contract, which is estimated to cost about $4,000,000.

---

### Hydro-Electric Contracts.

The following contracts have been awarded by the Hydro-Electric Power Commission.

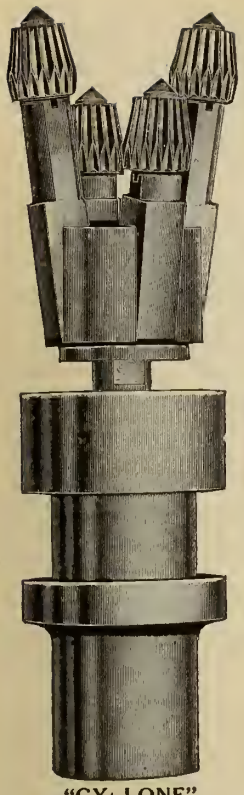
Cast iron boilers for heating the stations at Guelph and Preston, Taylor, Forbes Co., Guelph, $498.

Two steel boilers for heating the stations at Dundas and London, E. Leonard & Sons, London, $511.

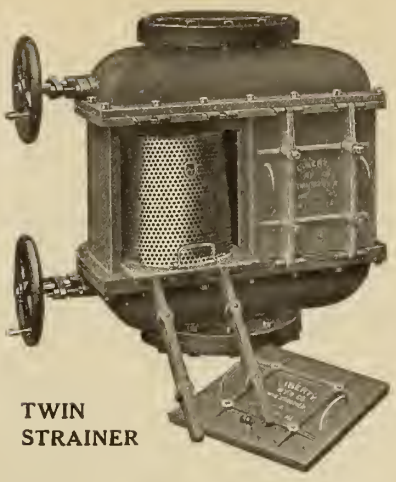
For steel boilers for heating the transformer stations at Niagara Falls and Toronto, to the John Ingles Co., Ltd., Toronto, $515.

Cast iron boilers for heating at Berlin, Stratford, St. Mary's, and St. Thomas, Gurney Foundry Co., Toronto, $952.

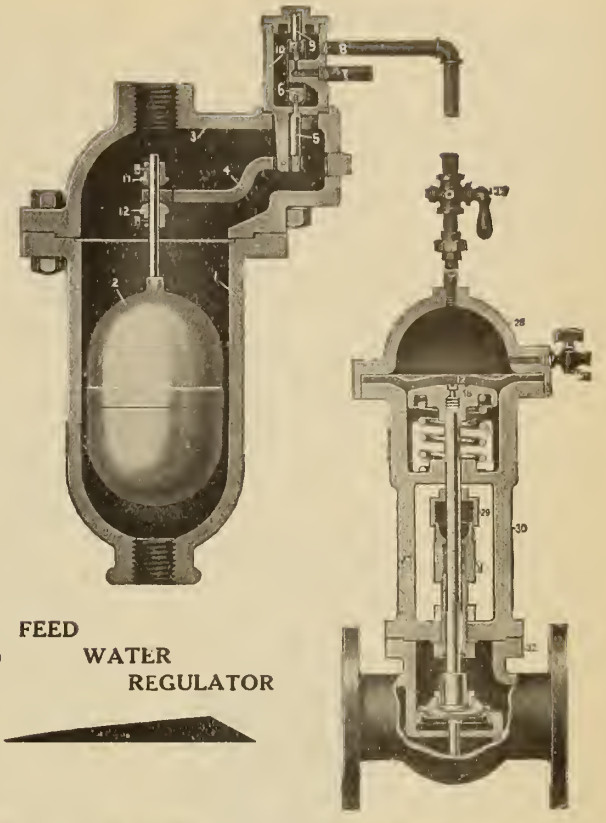
Tenders have been awarded for 12,000 volt conductor cable to Siemens Brothers' Dynamo Works, Eng., for $21,149 installed. The tender of the same firm has been accepted for submarine cable for $1,943.12, and for underground cable for $1,556. The contracts all come within the estimates.



"CYCLONE" CLEANER



TWIN STRAINER



FEED WATER REGULATOR

# The age of "Liberty"

The successful Power Plants – those which have discarded the old-fashioned, slow, cumbersome methods in favor of those more in keeping with the age—have eliminated all waste, and have made every dollar spent produce more than a dollar's worth of work.

And they have accomplished this by using modern methods—by installing

## Liberty Power Accessories!

Three of our money-saving, profit-increasing Accessories are shown here :

**The "Cyclone" Cleaner** removes the thickest and heaviest scale without any trouble. It is very simple and compact, and has a balanced blade which practically eliminates friction. Operated either by air or steam.

---

The chief feature of the Liberty **"Twin Strainer"** is the giving of continual service —while one basket is being cleaned the other is working—where there is any apparatus through which water or any liquid must flow, the "Twin Strainer" should be installed.

---

The **"Liberty" Feed Water Regulator** never sleeps! Could we give it a better character than this?

These and other "Liberty" specialties are described in detail in the "Liberty" Catalogue, which will be sent on request. Drop a postal for a copy—it costs you only one cent.

# Liberty Manufacturing Company

6705 SUSQUEHANNA STREET, - PITTSBURG

### Shawinigan Extensions.

During 1909 the Shawinigan Water & Power Co. bave added extensively to their high tension transmission lines. From Doucet Landing to Victoriaville, a distance of 45 miles, a new 50,000 volt line has been erected and when the projected line is completed to Thetford Mines the company will bave a double pole line between Shawinigan Falls and the various intermediate points. The Shawinigan Water & Power Co. have just completed the installation of additional equipment at their Shawinigan Falls station, consisting of an 8,000 k.w., 30 cycle, three-phase, 2,200 volt alternator, which is direct connected to a 12,000 h.p., I.P. Morris horizontal turbine. They have awarded the contract to the Canadian Westinghouse Co., for five 300 k.w. 30 cycle, three-phase transformers. These are rated for service on the 50,000 volt lines of the company.

The extension of the company's 50,000 volt lines to Windsor Mills, Que., and the contract formed at that point with the Canada Paper Co. for a supply of electric power, is rather unique. The company's mills are situated in a district where an abundant supply of water power is available, yet they have contracted for the more expensive electric load. This is partially accounted for by the fact that the water supply is not to be depended on in the summer time.

### Big Canadian Electric Merger.

One of the biggest financial deals in the history of Quebec was completed in Montreal some days ago, when an application for letters patent of incorporation of the Quebec Railway, Light, Heat and Power Co., were signed and forwarded to Ottawa. The capital of the merger is $10,000,000, and the companies taken in are the Quebec Railway and Power Co., until quite recently two companies; the Quebec Gas Co., the Canadian Electric of Chaudiere Falls fame, the Seven Falls Co., owned by the Quebec Power Co., and several smaller enterprises. The Montreal directors will be W. G. Ross, managing director of the Montreal Street Railway; Senator Mackay, Rodolphe Forget and J. N. Greenshields, K.C. The principal executive officer will be C. E. A. Carr, for some time past general manager of the Quebec Gas Co. Mr. Carr thus becomes the manager of one of the biggest corporations in Canada. He is an Ontario man by birth, but lived in Montreal for a number of years as general manager and secretary of the Montreal Park and Island Railway Company. He afterwards became general manager of the London, Ont., street railway, and was then called to Helena, Mont., where he was the manager of the Helena Light and Railway Co. From Helena he came east to manage the Quebec Gas Co. and now takes charge of the merger.

### Toronto's Pump Contracts.

The following are the descriptions of the pumps for Toronto's waterworks system, and the awards.

Section A—750 revolutions per minute, four pumps, with a capacity of 13,500,000 gallons, main pumping station; tenders from $14,800 to $52,200; awarded to Jens Orten Boving, London, Eng., $14,800.

Section B—Two pumps at the main pumping station, 5,000,000 gallons each, for the high-pressure fire system, from $11,703 to $35,000; awarded to the Caledonia Iron Works, $11,703.

Section C—Four pumps, each with a capacity of 10,000,000 gallons, to be installed at the high level pumping station, from $6,500 to $24,000; awarded to Jens Orten Boving, London, Eng., $6,500.

Section D—Four pumps, to be installed at the high level pumping station, 6,500,000 gallons each, from $7,385 to $18,400; awarded to the Caledonia Iron Works, $7,385.

Section E—Four pumps, to be installed at the Island, each with a capacity of 1,500,000 gallons, from $4,240 to $14,500; awarded to the Canadian General Electric Co., $4,822.

The tender of the Canadian Westinghouse Co., Hamilton, for the electric motors for the electric pumps to be installed at the main pumping station and high-level pumping station has been accepted by the Board of Control. The successful tender was for $107,765. The next lowest tender was from a Glasgow firm, $120,000.

# Power Supply Markets

## TORONTO.

Steam specialties continue to be in large demand and numerous installations are reported. Electrical lines are selling well and when the municipalities of Western Ontario begin buying there will be a big demand for electrical goods.

BOILERS—All the Toronto and Western Ontario manufacturers of boilers report an especially busy season with orders piling up. The staffs are as large as they have employed and there is a good winter's work in sight.

BOILER TUBES—Lap welded steel per 100 ft., 2-in., $8.50 to $8.75; 2½-inch, $10 to $10.75; 2½-inch, $10.75; 3-inch, $12; 3½-inch, $15, and 4-inch, $18.50 to $19.

COAL—Retail price for Pennsylvania hard, $6.75 net. This price applies to grate, egg, stove, and chestnut; pea coal is namely $5.75. These are cash.

BELTING—All hides entering the U. S. must be fumigated. This, it is thought, will reduce the price of hides in Canada as the cost of fumigating is very high. Three classes are directly affected. The tanners should rejoice because it will mean an abundance of cattle hides with a probable decrease in price. The farmers who have cattle hides to sell will not be pleased, nor will be dealers who act as middlemen between them and the manufacturers.

Mr. Walter Beardmore, of the Beardmore Co., tanners, 51 Front St. East, Toronto:

"The American law requires that all foreign hides must show certificates of fumigation before entering American ports. This is rigidly enforced, for example, at New York and Boston. Apparently Canada has been exempt, being considered, so far as the hide trade is concerned, a part of the United States. To me this move on the part of the American Customs officers seems to be a mere enforcing against Canada of the same law now enforced against other foreign countries."

Mr. Beardmore stated that the hides bought by his firm are fumigated in the country where they are produced. Then the certificates are merely shown at New York or Boston as the shipments come through.

MECHANICAL RUBBER GOODS—With heavier arrivals of the new crop, fine Para rubber has fallen from a recent high record quotation of $2.14 to $1.95 per pound, and if expectations in various quarters are fulfilled still lower figures will be reached in the early future. Leading trade interests estimate that the total current yield will exceed that of last year by at least 10 per cent. owing to the exceptionally high prices that have been in force for a long time.

In explanation of the readjustment in market conditions one authority made the following statement: "The receipts at Para for October were 400 tons short of those for the same month last year, while the figures covering the first quarter of the present crop show a falling off of 340 tons, or 3¾ per cent., as compared with 1908-9. This shortage has to do with up-river goods, which can be accounted for by low waters that have marked the situation in the upper tributaries of the Amazon. Advices from Manaos show that in October the rivers were rising there. This is reflected in the fact that receipts during that month were larger than in October, 1908, by 395 tons. For the first quarter a decrease is shown of only six tons compared with 1908-9. These increased receipts at Manaos will probably pass through Para during the present month, making the coming crop on December 1 about equal to the same period a year ago.

LEAD WOOL—Price $10.50 per 100 lbs. and $200 per ton.

FIRE BRICKS—Scotch and English, $30 to $35; American, $25 to $35 per 1,000.

## MONTREAL.

It would be hard to say just when the condition of the market for steam specialties has been so active as it is at present. This activity has all the earmarks of permanency and increase.

Steam traps have accelerated during the past month, due, not a little no doubt, to the arrival of cold weather and the turning on of heating systems. One of the large makers of steam traps here state that hardly a day passes without satisfactory orders—not inquiries—coming in for this steam specialty.

Peilet & McKenzie have just finished the installation of a complete equipment of Bundy Traps for handling the condensation in the heating and drying departments of the Stormont plant of the Dominion Colored Cotton Co., at Cornwall, Ont. As a result of this installation the mills are running with one boiler less, at this time when heating is also required, than they used for the drying alone last August.

This firm has also just finished a complete system of Bundy traps for handling the condensation in the Moncton Mill of the Dominion Textile Co.

In general power lines business is very brisk. Every house reports an abundance of inquiries and orders which are taxing the production capacity of the interested plants to the utmost. The Montreal sales office of one of the largest producers of these lines in Canada has just passed through what has been the best month in their history and the increase has been so steady and sure that they are planning to move into much larger offices after the New Year.

As next month is usually "inventory month" with most concerns, special efforts are being made to get the boards fairly clean by stock taking time. Prices in general power supplies are likely to ease a little, the lower tendency being due to the fact that such a volume of work as is on hand lowers the cost of production proportionately and thus salesmen are able to quote better discounts. One of the difficulties at present is the getting of any sort of early delivery. Except in isolated cases delivery is slow—another logical result of the increase in sales. This is being met with in some cases by extensions to plants, as witness the new warehouse of Darling Bros., mentioned in these pages some time ago.

The Robb Engineering Co. have moved their offices to 607-8, Canadian Express building, with R. W. Robb in charge.

The new Belliss & Morcom vertical engine supplied by Laurie & Lamb, had its first run on Nov. 28th and gives evidence of the usual satisfaction which these units create. The exhaust steam is condensed by a Knowles jet condenser which also handles the exhaust from the new auxiliaries. The circulating water is taken from the hot well at about 110 to 130 deg. Fah. and elevated to the top of the cooling tower by a Worthington centrifugal pump driven by a Robb engine at 420 r.p.m. The official test has not yet been made on these new additions, but those in charge expect to have this finished before the finish of the new year.

# PUMPS TANKS

For General Water Supply

PUMPS
Tank Supply
Boiler Feed
Fire Service
in stock.

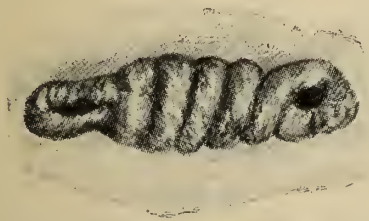
R. H. BUCHANAN & CO.
234 Craig St. West - - - - MONTREAL



# JOHN GARDE & CO.

142 Victoria Street TORONTO, ONT.
'Just around the corner from Queen and Yonge

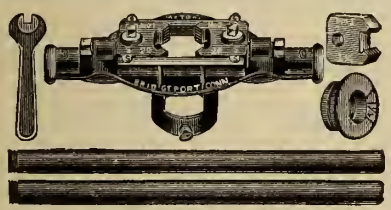
Sole Distributors in Canada for the British Manufacturers



A Strand of Lead Wool coiled up for transit

THE MODERN JOINTING
LEAD WOOL
"SHREDDED LEAD."
MADE IN ENGLAND





GENUINE
ARMSTRONG STOCKS
AND DIES
FOR CUTTING PIPE & BOLTS
ARE THE BEST.

PIPE MACHINES
PIPE CUTTERS
HINGED PIPE VISES
RATCHET ATTACHMENTS

Manufactured by
THE ARMSTRONG MFG. CO.
298 Knowlton St.
BRIDGEPORT, CONN.
NEW YORK CHICAGO
Catalog mailed on request


## CATALOGUES.

STEAM AND WATER SPECIALTIES—Catalogue No. 12, from the Golden-Anderson Co., Pittsburg, describes their steam specialties. Their line includes Golden cushioned non-return valves, pilot valves, reducing valves, check valves, globe valves, angle valves, Golden tilting steam traps, water gauges, controlling attitude valves, float valves standpipes, etc.

TAYLOR STOKER—The Taylor system of combustion is explained in a booklet "Mechanical Control of Air and Coal," issued by the American Ship Windlass Co., Providence, R. I. Illustrations show several installations and the application of the stoker to various types of boilers.

FEED WATER HEATER—Chas. Jacobs & Co., 51 Oliver St., Boston, Mass., have issued a booklet descriptive of the Jacobs Water Tube Feed Water Heater; Lowden grease, oil and grit extractor; and Lowden automatic water separator. Full dimensions are given for the various sizes, with descriptions of these specialties.

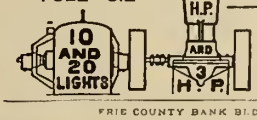
## BOOK REVIEWS.

DIRECT AND ALTERNATING CURRENT TESTING—By Frederick Bedell, Ph. D., professor of applied electricity in Cornell University, assisted by Clarence A. Pierce, Ph. D. Published by D. Van Nostrand Co., 23 Murray St., New York, 265 pages, 5½ x 8½ ins., illustrated. Price $2 net.

This manual consists of a series of tests on direct and alternating current apparatus selected with reference to their practical usefulness and instructive value. The significance of the results are pointed out and also the principles underlying the various experiments.

The book is divided into seven chapters, divided as follows: 1. D. C. Generators, 2. D. C. motors, 3. Synchronous alternators, 4. Single-phase currents, 5. Transformers, 6. Polyphase currents, and 7. Phase changes, potential, regulators, etc. Such subjects of measurement of Power and Power Factor are treated, all the subjects being carefully indexed. While the book was primarily written for students, it should be helpful to others and may be used to advantage in conjunction with standard texts on electrical engineering.


DYNAMO-ENGINE-SETS
FUEL - OIL - GASOLENE - ALCOHOL




THE BUFFALO MECHANICAL AND ELECTRICAL LABORATORY.
ERIE COUNTY BANK BLDG., BUFFALO, N. Y., U. S. A.



U.S. AND BARKEEPERS FRIEND
METAL POLISH
USED AND ENDORSED BY THE LEADING DEALERS
SOLD ALL OVER THE WORLD



Chief Draftsman AND ENGINEER

will personally—practically instruct a few ambitious, deserving, bright men on practical, actual, up-to-date Drafting Room Work at home, prepare and qualify them as first-class experienced Draftsmen and Designers for a salary paying $100 to $150 per month.

Instructions until competent, and placed in position free. Also complete high grade drawing outfit, with German Silver set of instruments worth $13.85 free this month. Don't answer this unless you are ambitiously seeking success and willing to work for results.

Address CHIEF DRAFTSMAN, Div. 22
ENGINEERS EQUIPMENT CO. (INC.) CHICAGO, ILL.



# ELECTRIC BARGAINS

We have some GOOD, PRACTICALLY NEW, MOTORS GOING AT A SACRIFICE

We manufacture alternating and direct current motors in all sizes also sell Century single phase motors in all their sizes. Repairs promptly and cheaply performed.

JONES & MOORE ELECTRIC CO., Limited
294-300 Adelaide St. West Toronto, Ont



# HERCULES Seamless Copper FLOATS
Are Absolutely Reliable

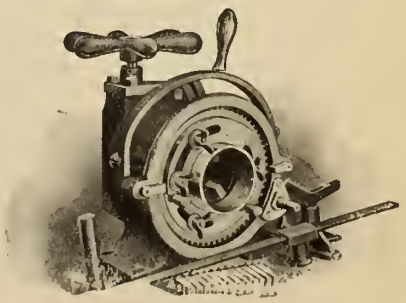
We guarantee every one to give you entire satisfaction.

We will send you our new CATALOG "C" on request,

Hercules Float Works
P.O. Box 396. Springfield, Mass.



# ECONOMIZE
Man Power



One man with our pipe-threading and cutting machine can do more work, do it better, and at less expense than 3 or 4 men working in the old-fashioned way.

It's the man-power that expands the cost.

CIRCULAR?

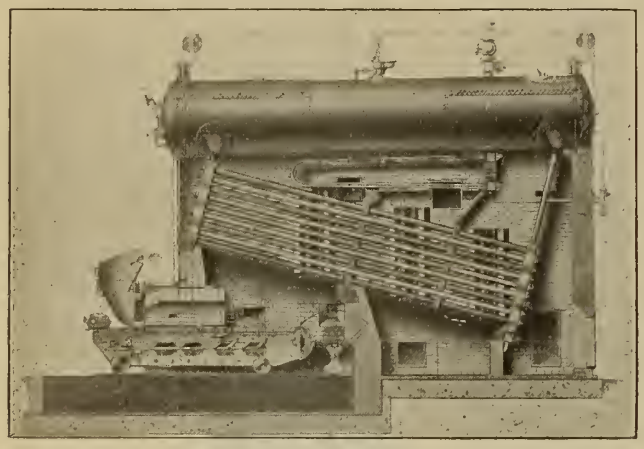
THE CURTIS & CURTIS CO.
26 Garden Street,
BRIDGEPORT, - - CONN.

# BABCOCK & WILCOX, Limited

## "B. & W." PATENT WATER TUBE BOILERS

With Furnaces for all Classes of Fuel or Waste Gases

HIGHEST ECONOMY, SAFETY, DURABILITY — OVER 7,000,000 H.P. IN USE



Babcock & Wilcox Patent Water Tube Boiler, Superheater, and Mechanical Stoker

ALSO

**Steam Superheaters**
**Mechanical Stokers**
**Coal-Handling Machinery**
**Piping, Feed Water Heaters**
**Water Softeners and Purifiers**
**and ELECTRIC CRANES**

Our Book "STEAM" sent on request

HEAD OFFICE FOR CANADA - NEW YORK LIFE BUILDING, MONTREAL

TORONTO OFFICE, TRADERS BANK BUILDING

# POWER EQUIPMENT

### Gas and Gasoline Engines

1 new 35—40 H.P. Petrie horizontal gas engine.
1 refitted 25 H.P. vertical marine gasoline engine
1 new 15—18 H.P. Petrie horizontal gas engine.
1 new 13—16 H.P. Petrie horizontal gas engine.
1 refitted 14 H.P. Petrie horizontal gas engine.
1 refitted 12—14 H.P. horizontal gasoline engine.
1 refitted 10—12 H.P. Stockport horiz. gas engine.
1 refitted 10 H.P. Labatt vertical gasoline engine.
1 refitted 9—11 H.P. horizontal gas engine.
1 new 8 H.P. Petrie horizontal portable gasoline engine with woodyard saw.
1 refitted 8 H.P. Haggis horizontal gasoline engine.
1 new 6 H.P. Simplex horizontal gasoline engine.
1 new 6 H.P. Stover horizontal gasoline engine.
1 refitted 6 H.P. Northey vertical gasoline engine.
1 refitted 6 H.P. Olin horizontal gasoline engine.
1 refitted 4½—5½ H.P. horizontal gasoline engine.
1 new 4—5 H.P. Petrie horizontal gasoline engine.
1 refitted 4—5 H.P. Otto horizontal gas engine.
3 refitted 3 H.P. Imperial vertical gasoline engines.
1 refitted 3 H.P. Ideal horizontal gasoline engine.
1 refitted 3 H. P. vertical gasoline engine.
1 new 1½—2 H.P. Acme marine gasoline engine.

### Electric Motors

1 refitted 50 H.P. Jones & Moore, 220 volts, alternating current motor.
1 refitted 20 H.P. Jones & Moore, 220 volts, alternating current motor.
1 refitted 15 H.P. Jones & Moore, 250 volts, direct current motor.
1 new 12 H.P. Queen City, 220 volts, direct current motor.
2 refitted 12 H.P. Jones & Moore, 220 volts, alternating current motors.
1 refitted 12 H.P. Consolidated 250 volts, direct current motor.
1 nearly new 8 H.P. Consolidated, 250 volts, direct current motor.
1 refitted 8 H.P. United Electric, 250 volts, direct current motor.
2 new 5 H.P. Kay, 250 volts, direct current motors.
1 refitted 2½ H.P. 2 phase, alternating cur. motor.
1 refitted 2 H.P. Jones & Moore, 500 volts, direct current motor.
1 refitted 2 H.P. Jones & Moore, 110 volts, direct current motor.
1 new 1 H.P. 220 volts, alternating current motor.
1 refitted 1 H.P. 220 volts, direct current motor connected to air pump.

### Generators

2 refitted 100 K.W. Canadian General, direct current generators.
1 nearly new 100 K.W. Canadian General, alternating current generator.

### Engines and Boilers

1, 10"x11" Abell portable engine and boiler.
1, 9½"x11" White portable engine and boiler.
1, 8"x12" semi-portable engine and boiler.
1, 8"x10" White portable engine and boiler.
1, 7"x10" Champion portable engine and boiler.
1, 7"x10" Waterloo portable engine and boiler.
2, 5½"x7" vertical engines and boilers.
1 refitted 14 H.P. Cornell traction engine.
1 refitted 10 H.P. Westinghouse traction engine.
1 refitted 48"x11'6" semi-portable return tube boiler.
1 refitted 30"x10" semi-portable return tube boiler.
1 refitted 48"x20" semi-portable fire box boiler.
1 new 36"x13'3" semi-portable fire box boiler.
1 refitted 36"x12' 10" semi-portable fire box boiler.
1 new 30"x11'7" semi-portable fire box boiler.

*OUR SUPPLY CATALOGUE OR MACHINERY STOCK LIST ON REQUEST*

# H. W. PETRIE, Ltd., Toronto, Montreal, Vancouver

# THE POWER HOUSE BUYERS' DIRECTORY

**To Our Readers,—Use this directory when seeking to buy power equipment or supplies. You will often get information that will save you money.**

**To Our Advertisers,—Send in your name for insertion under the heading of the lines you make or sell.**

**To Non-Advertisers,—A nominal rate of $1 per line a year is charged non-advertisers.**

## Acids.

Canada Chemical Mfg. Co., London

## Air Brakes.

Allis-Chalmers-Bullock, Ltd., Montreal

## Air Compressors.

Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Montreal

## Air Chambers.

Hercules Float Works, Springfield, Mass.

## Air Vents, Automatic.

Canadian Steam Boiler Equipment Co., Toronto

## Arches, Boiler Door.

McLeod & Henry Co., Troy, N.Y.

## Arches, Combustion Chamber

McLeod & Henry Co., Troy, N.Y.

## Babbitt Metal.

R. H. Buchbnan & Co., Montreal
Canada Metal Co., Toronto.

## Bearings, Self-Oiling.

J. C. Wilson & Co., Glenora, Ont.

## Belt Dressing.

R. H. Buchanan & Co., Montreal
Plomo Specialty Mfg. Co., Cleveland

## Belt Tighteners.

Waterous Engine Works Co., Brantford.

## Belting, Leather.

J. D. McArthur, Brockville
J. L. Goodhue & Co., Danville, Que.
D. K. McLaren, Ltd., Montreal.
Sadler & Haworth, Montreal.

## Blowers.

W. H. Adams, 102 Nazareth St., Montreal, Que.
Russell & Gifford, Montreal
Turbo-Blower Co., New York

## Boiler Compounds.

Electric Boiler Compound Co., Guelph, Ont.
Hygienic Laboratories, Toronto
Nichols Chemical Co., Montreal
The "Skaleoff" Co., Montreal
C. C. Snowdon, Calgary

## Boiler Compound Feeders.

Hygienic Laboratories, Toronto
Michigan Lubricator Co., Detroit
Morehead Mfg. Co., Detroit, Mich.

## Boiler Feed Pumps.

R. H. Buchanan & Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Darling Bros., Montreal

## Boiler Feed Regulators.

Bain & Mitchell, Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Boiler Mountings.

Babcock & Wilcox, Montreal
Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peiler & MacKenzie Montreal
Standard Engineering Co., Toronto.

## Boiler Tube Cleaners.

Liberty Mfg. Co., Pittsburg
Michigan Lubricator Co., Detroit
Wm. B. Pierce Co., Buffalo

## Boilers.

Babcock & Wilcox, Montreal
Brownell Co., Dayton, Ohio.
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Jones Underfeed Stoker Co., Montreal.
E. Leonard & Sons, London, Ont.
Polson Iron Works, Toronto
Standard Engineering Co., Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Horizontal Tubular.

Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
H. W. Petrie, Toronto.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Marine.

Babcock & Wilcox, Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Vertical.

Goldie & McCulloch Co., Galt.
H. W. Petrie, Toronto.
Jenckes Machine Co., Sherbrooke, Que.
Polson Iron Works, Toronto
Waterous Engine Works Co., Brantford.

## Boilers, Water Tube.

Babcock & Wilcox, Montreal
Polson Iron Works, Toronto

## Boosters.

Geo. C. Royce, West Toronto

## Canners' Machinery.

J. C. Wilson & Co., Glenora, Ont.

## Cars, Transfer.

Corbet Foundry and Machine Co., Owen Sound

## Castings, Brass.

Hercules Float Works, Springfield, Mass
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
J. C. Wilson & Co., Glenora, Ont.

## Cement Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Chemicals.

Nichols Chemical Mfg. Co., Montreal

## Circuit-Breakers.

Geo. C. Royce, West Toronto

## Coal and Ash Conveyors.

Babcock & Wilcox, Montreal

## Coal Handling Machinery

Standard Engineering Co., Toronto

## Combustion Recorder.

Canadian Instrument and Testing Co. Montreal.

## Condensers.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
J. P. Devine Co., Buffalo, N.Y.
Goldie & McCulloch Co., Galt.

## Consulting Engineers.

Bain & Mitchell, Montreal
de Gaspe Beauhien, Montreal
Death & Watson, Toronto.
John T. Farmer, Montreal
Walter J. Francis, Montreal.
Galt & Smith, Toronto.
F. M. G. Johnson, Montreal
Edward B. Merrill, Toronto.
Messrs. Mitchell, Toronto
Moore & Scollan, Toronto
John B. McRae, Ottawa
J. M. Robertson, Montreal.
M. A. Sammett, Montreal.
J. M. Shanly, Montreal.
Smith, Kerry & Chace, Toronto
Standard Engineering Co., Toronto

## Contractors, Structural Steel

Corbet Foundry and Machine Co., Owen Sound

## Cork Insulation.

Linde British Refrigeration Co., Montreal

## Coppersmiths.

Hercules Float Works, Springfield, Mass.

## Couplings.

J. C. Wilson & Co., Glenora, Ont.

## Cranes, Electric.

Babcock & Wilcox, Montreal

## Crank Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.

## Cross Head Pins.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Crushing Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal

## Damper Regulators.

Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Dredges.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drills, Rock.

Allis-Chalmers-Bullock, Ltd., Montreal

## Drying Machinery.

J. P. Devine Co., Buffalo N.Y.

## Dynamos.

Allis-Chalmers-Bullock, Ltd., Montreal
Mechanical & Elec. Lab., Buffalo
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto.

## Economizers.

Babcock & Wilcox, Montreal

## Electric Power Instalations.

Allis-Chalmers-Bullock, Ltd., Montreal
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto
Packard Electric Co., St. Catharines.

## Electrical Accessories.

Chapman & Walker, Toronto

## Electrical Machinery.

Chapman & Walker, Toronto

## Electrical Repairs.

Canadian Electrical & Motor Co., Toronto
Electrical Maintenance & Repair Co., Toronto.
Jones & Moore Electric Co., Toronto
Northern Electric Supply Co., Orillia, Ont.

## Elevating Machinery.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford

## Engines, Automatic.

E. Leonard & Sons, London, Ont.
H. W. Petrie, Toronto.

## Engines, Corliss.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch, Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Vilter Mfg. Co., Milwaukee, Wis.

## Engines, Gas and Gasoline.

Allis-Chalmers-Bullock, Ltd., Montreal
Chapman & Walker, Ltd., Toronto
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co, Toronto
Fielding & Platt, Ltd., Gloucester, Eng
Gas & Electric Power Co., Toronto.
Goold, Shapley & Muir Co., Brantford
W. H. Oliver & Co., Toronto.

## Engines, High Speed, Steam.

Brownell Co., Dayton, Ohio
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Medium and Low Speed.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont
Waterous Engine Works Co., Brantford.

## Engines, Saw Mill.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Waterous Engine Works Co., Brantford

## Engines, Simple and Compound.

Brownell Co., Dayton, Ohio
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Levy & Westwood Machinery Co., Toronto.
Kerr Engine Co., Walkerville
Waterous Engine Works Co., Brantford

## Engines, Vertical.

H. W. Petrie, Toronto.

## Exhaust Heads.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Russel & Gifford, Montreal
Standard Engineering Co., Toronto.

## Feed Water Analyser.

Canadian Instrument and Testing Co., Montreal.

## Feed Water Heaters

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Brownell Co., Dayton, Ohio
Darling Bros., Montreal
Goulds Pump Co., Montreal.
C. Jacobs & Co., Boston, Mass.
E. Leonard & Sons, London, Ont.
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Fire Box Blocks.

McLeod & Henry Co., Troy, N.Y

## Fire Brick.

McLeod & Henry Co., Troy, N.Y

## Flanges

Dart Union Co., Toronto

## Floats, Seamless, Copper.

Hercules Float Works, Springfield, Mas

## Flumes, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Fuses.

Geo. C. Royce, West Toronto

## Gas Producer Plants.

Bain & Mitchell, Montreal
Chapman & Walker, Ltd., Toronto
Colonial Engineering Co., Montreal
Dymond Gas & Engine Co., Toronto
Fielding & Platt, Ltd., Gloucester, Eng
Gas & Electric Power Co., Toronto.
W. H. Oliver & Co., Toronto

## Gauges, Pressure, Vacuum and Recording.

Babcock & Wilcox, Montreal
Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Gears, Angle.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Cut.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Mortise.

J. C. Wilson & Co., Glenora, Ont.

## Gears, Worm.

J. C. Wilson & Co., Glenora, Ont.

## Generators.

Allis-Chalmers-Bullock, Montreal
Canadian Electrical & Motor Co., Toronto
Chapman & Walker, Ltd., Toronto
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Governors.

Allis-Chalmers-Bullock, Ltd., Montreal
E. Leonard & Sons, London, Ont.

## Governors, Water Wheel.

J. C. Wilson & Co., Glenora, Ont.

## Grates.

Babcock & Wilcox, Montreal
Butterworth Foundry Co., Ottawa
Canada Gas Power & Fuel Co., Montreal
Canadian Steam Boiler Equipment Co. Toronto
Diamond Grate Bar Co., Berlin, Ont.

## Gravity Closing Ventilators.

Standard Engineering Co., Toronto.

## Grease Cups.

Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Peterboro Lubricator Mfg. Co., Peterboro

## Grease and Oil Extractors.

C. Jacobs & Co., Boston, Mass.

## Greases

Electric Boiler Compound Co., Guelph Ont.

## Hangers.

Goldie & McCulloch Co., Galt.
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

## Heaters.

Darling Bros., Montreal
Goldie & McCulloch Co., Galt.
E. Leonard & Sons, London, Ont.

## Ice Making Machinery.

Linde British Refrigeration Co., Montreal
Vilter Mfg. Co., Milwaukee, Wis.

## Indicators, .Electric—All Types.

Geo. C. Royce, West Toronto

## Indicators, Steam Engine.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Injectors.

Lunkenheimer Co., Cincinnati, Ohio
Jas. Morrison Brass Mfg. Co., Toronto.
Penberthy Injector Co., Windsor.

## Lamps, Incandescent,

Chapman & Walker, Toronto
Packard Electric Co., St. Catharines

## Lead Wool.

John Garde & Co., Toronto.

## Lubricators, Force Feed.

Darling Bros., Montreal
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis
Sterling Lubricator Co., Rochester, N.Y.

## Maple Cogs.

J. C. Wilson & Co., Glenora, Ont.

## Mechanical Stokers.

Babcock & Wilcox, Montreal
Jones Underfeed Stoker Co., Montreal.
Standard Engineering Co., Toronto

## Meters, Electric

Geo. C. Royce, West Toronto

## Meters, Water

Peiler & MacKenzie, Montreal

## Mill Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Madison Williams Mfg. Co., Lindsay, Ont
Waterous Engine Works Co., Brantford
J. C. Wilson & Co., Glenora, Ont.

## Mining Machinery.

Allis-Chalmers Bullock, Ltd., Montreal

## Motors.

Allis-Chalmers-Bullock, Ltd., Montreal
Canadian Electrical & Motor Co., Toronto
Chapman & Walker, Ltd., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Jones & Moore Electric Co., Toronto
Kilmer & Pullen, & Burnham, Toronto.
Packard Electric Co., St. Catharines.

## Motor Starters.

Chapman & Walker, Ltd., Toronto
Geo. C. Royce, West Toronto

## Oil and Waste Saving Machines.

The anadian Oil & Waste Saving Machnie Co., Brockville, Ont.

## Oilers, Gang.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis

## Oil Filters

Darling Bros., Montreal

## Oil Separators.

Babcock & Wilcox, Montreal
Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
C. Jacobs & Co., Boston, Mass.
Liberty Mfg. Co., Pittsburg
Peiler & MacKenzie, Montreal
Russel & Gifford, Montreal
Standard Engineering Co., Toronto

## Oils, Lubricating.

Electric Boiler Compound Co., Guelph Ont.
The "Skaleoff" Co., Montreal, Que.

## Packing, Leather.

R. H. Buchanan & Co., Montreal
Detroit Leather Specialty Co., Detroit
Electric Boiler Compound Co., Guelph, Ont.

## Packing, Metallic.

Rhodes Improved MetallicPacking Co. Montreal

## Panels, Electric

Hill Electric Switch Co., Montreal

## Perforated Metals.

Allis-Chalmers-Bullock, Ltd., Montreal

## Pipe Cutting and Threading Machines.

Curtis & Curtis Co., Bridgeport, Conn.

## Pipe Threading Tools.

Borden-Canadian Co., Toronto.
Curtis & Curtis Co., Bridgeport, Conn.

## Piping, Steam,

Babcock & Wiloox, Montreal

## Planimeters.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Plate Work.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford

## Polish, Metal,

G. W. Hoffman, Indianapolis

## Power Pumps.

R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCullock Co., Galt.
Goulds Pump Co., Montreal.
Waterous Engine Works Co., Brantford

## Power Transmission Machinery.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

## Processing Retorts.

J. C. Wilson & Co., Glenora, On

## Pulleys, Iron.

J. C. Wilson & Co., Glenora, Ont.

## Pumping Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
R. H. Buchanan & Co., Montreal

## Pump Governors.

Canadian Steam Boiler Equipment Co., Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto.

## Pump Strainers.

Canadian Steam Boiler Equipment Co. Toronto

## Pumps, Air,

Lunkenheimer Co., Cincinnati, Ohio

## Pumps, Oil.

Michigan Lubricator Co., Detroit
Sight Feed Oil Pump Co., Milwaukee, Wis.
Sterling Lubricator Co., Rochester, N.Y.

## Refrigeration Machinery.

Linde British Refrigeration Co., Montreal
Vilter Mfg. Co., Milwaukee, Wis.

## Reducing Wheels.

Peiler & MacKenzie, Montreal
Jas. L. Robertson & Sons, New York.

## Rheostats.

Geo. C. Royce, West Toronto

## Safes.

Goldie & McCulloch Co., Galt.

## Safety valves.

Lunkenheimer Co., Cincinnati, Ohio
Peiler & MacKenzie, Montreal

## Shafting.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
Waterous Engine Works Co., Brantford.
J. C. Wilson & Co., Glenora, Ont.

## Shaking and Dumping Grate

Babcock & Wilcox, Montreal
Standard Engineering Co., Toronto

## Smoke Consumers.

Canadian Steam Boiler Equipment Co., Toronto
The "Skaleoff" Co., Montreal, Que.

## Smoke Stacks.

Babcock & Wilcox, Montreal
Corbet Fouudry and Machine Co., Owen Sound

## Special Machinery.

Electrical Maintenance and Repair Co. Toronto.

## Sprocket Wheels.

J. C. Wilson & Co., Glenora, Ont.

## Spur Wheels.

J. C. Wilson & Co., Glenora, Ont.

## Steam Pumps.

R. H. Buchanan & Co., Montreal
Darling Bros., Montreal
Goldie & McCulloch Co., Galt.

## Steam Separator.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Russel & Gifford, Montreal

## Steam Specialties.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Jas. Morrison Brass Mfg. Co., Toronto.
Peiler & MacKenzie, Montreal
Penberthy Injector Co., Windsor.
Russel & Gifford, Montreal
Standard Engiueering Co., Toronto.

## Steam Traps.

Darling Bros., Montreal
Ideal Steam Separator & Supply Co., Toronto
Morehead Mfg. Co., Detroit, Mich.
Peiler & MacKenzie, Montreal
Russell & Gifford, Montreal
Standard Engineering Co., Toronto

## Stokers.

Erie Foundry Co., Erie, Pa.

## Switches, Electric

Hill Electric Switch Co., Montreal

## Superheaters, Steam,

Babcock & Wilcox, Montreal

## Switchboards, Light and Power.

Allis-Chalmers-Bullock, Ltd., Montreal
Chapman & Walker, Ltd., Toronto
Electrical Maintenance and Repair Co. Toronto.
Gas & Electric Power Co., Toronto.
Hill Electric Switch Co , Montreal
Geo. C. Royce, West Toronto

## Switches.

Geo. C. Royce, West Toronto

## Tanks, Blow-off

Darling Bros., Montreal

## Tanks, Oil.

Goldie & McCulloch Co., Galt.
Jenckes Machine Co., Sherbrooke, Que.
E. Leonard & Sons, London, Ont.
Sight Feed Oil Pump Co., Milwaukee, Wis.
Waterous Engine Works Co., Brantford.

## Tanks, Steel.

Corbet Foundry and Machine Co., Owen Sound

## Tests and Inspections.

Bain & Mitchell, Montreal

## Transformers.

Allis-Chalmers-Bullock, Ltd., Montreal
Chapman & Walker, Ltd., Toronto
Geo. C. Royce, West Toronto

## Transmission Machinery.

Allis-Chalmers-Bullock, Ltd., Montreal
Goldie & McCulloch Co., Galt, Ont.
Waterous Engine Works Co., Brantford.

## Trucks, Dry Kiln.

Corbet Foundry and Machine Co., Owen Sound, Ont.

## Trucks, Factory.

Corbet Foundry and Machine Co., Owen Sound

## Tubes, Boiler,

Babcock & Wilcox, Montreal

## Turbine Water Wheels.

Allis-Chalmers-Bullock, Ltd , Montrea
Jenckes Machine Co., Sherbrooke, Que
The Madison Williams Mfg. Co., Lindsay, Ont.
J. C. Wilson & Co., Glenora, Ont.

## Turbines, Steam.

Allis-Chalmers-Bullock, Ltd., Montreal
Dymond Gas & Engine Co., Toronto

## Unions

Dart Union Co., Torouto
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit

## Vacuum Drying and Impregnating Apparatus.

J. P. Devine Co., Buffalo, N.Y

## Vacuum Governors.

Canadian Steam Boiler Equip ent Co., Toronto

## Vacuum Pans.

J. P. Devine Co., Buffalo, N.Y.

## Vacuum Pumps.

Canadian Steam Boiler Equipment Co., Toronto
J. P. Devine Co., Buffalo, N.Y.

## Vacuum Regulating Valves.

Canadian Steam Boiler Equipment Co Toronto
Darling Bros., Montreal
Peiler & MacKenzie, Montreal
Standard Engineering Co., Toronto

## Vacuum Traps.

Morehead Mfg. Co., Detroit, Mich.
Russel & Gifford, Montreal

## Valve Reseating Machines

Darling Bros., Montreal

## Valves.

Canadian Steam Boiler Equipment Co T ronto
Jenkins Bros., Montreal
Kerr Engine Co., Walkerville, Ont.
Lunkenheimer Co., Cincinnati, Ohio
Michigan Lubricator Co., Detroit
Standard Engineering Co., Toronto.

## Vaults & Vault Doors.

Goldie & McCulloch Co., Galt.

## Water Purifiers.

Babcock & Wilcox, Montreal

## Water Softeners.

Babcock & Wilcox, Montreal

## Watt Meters.

Chapman & Walker, Ltd., Toronto
Gas and Electric Power Co., Toronto

## MISCELLANEOUS.

ANY MAN who has ever lost money in the mails has had occasion to learn by painful experience that the only proper way to remit money is by Dominion Express Money Orders and Foreign Drafts. If lost or delayed in the mails, a prompt refund is arranged, or new Order issued without further charges. (tf)

ADDING TYPEWRITERS write, add or subtract in one operation. Elliot Fisher, Limited, 129 Bay Street, Toronto.

BEFORE buying office furniture, filing systems and supplies, see our catalog. Our modern goods at moderate prices will result in money-saving and satisfaction. Write to-day, stating your requirements. Benson Johnston Co., Limited, 8 John Street N., Hamilton. (tf)

CASH AND PACKAGE CARRIERS — Better and quicker service in your store results from the Installation of the "GIPE" system of Cash or Parcel Carriers. They are the latest, strongest, simplest and most effective on the market. Will centralize your business and more than pay for themselves in the first year. Write for catalogue. Gipe Carrier Co., 97 Ontario St., Toronto. (tf)

DOUBLE YOUR FLOOR SPACE. An Otis-Fensom hand-power elevator will double your floor space, enable you to use that upper floor either as stock room or as extra selling space, at the same time increasing space on your ground floor. Costs only $70. Write for catalogue "B." The Otis-Fensom Elevator Co., Traders Bank Building, Toronto. (tf)

HARRISON FISHER CALENDARS for 1910 make excellent Christmas or New Year gifts. Five pages in full colors. Size 14 x 22 inches. Pictures may be removed and framed at the end of the year as they are only "tipped" on the mounts. Price $3 boxed. Copp, Clark Co., Ltd., Toronto, are Sole Agents for Canada. (tf)

KAY'S furniture catalogue No. 36 contains 160 pages of fine half-tone engravings of newest designs in carpets, rugs, furniture, draperies, wall papers and pottery with cash prices. It brings you into close touch with the immense stocks and splendid manufacturing facilities of John Kay Company, Ltd., 36 King St. West, Toronto. Write for a copy to-day. It's free. (tf)

PROBABLY the most talked about machine in Canada is the Hainer Book-keeping Machine. It combines in one machine the cash and credit register, time recorder and account register. We want representatives everywhere. Write for our proposition. Book-keeping Machines, Ltd., 424 Spadina Avenue, Toronto. (tf)

SAVE 70% OF YOUR LIGHT BILL by using the "Juat" Tungsten Lamp. Fits any socket. Burns any angle. All candlepowers from sixteen up. Prices as low as 50 cents. Better write us to-day. Sterling Electric Supply Co., Ltd., 369 Yonge St., Toronto, Ont. (tf)

"SYSTEMS" stand for all that is best in loose-leaf binders and supplies, letter-heads, statements and in fact your office stationery of every description. Send us samples of what you are using—we will send you prices that will interest you. Business Systems, Limited, Manufacturing Stationers, Toronto. (tf)

SAVE 50% OF THE COST OF HANDLING merchandise by installing a Beath System of Overhead Carriers. Saves valuable floor space because the trackage is on the ceiling. Systems for all kinds of businesses, large or small. Write us for Illustrated catalog. W. D. Beath & Son, 193 Terauley Street, Toronto. (tf)

TAYLOR-FORBES COMPANY, LIMITED. Head Office, Works and Foundries, Guelph. Largest manufacturers of hardware in Canada. (tf)

THE "Kalamazoo" Loose Leaf Binder is the only binder that will hold just as many sheets as you actually require and no more. The back is flexible, writing surface flat, alignment perfect. It cannot get out of order. No exposed metal parts or complicated mechanism. Write for booklet. Warwick Bros. & Rutter, Ltd., King and Spadina, Toronto.

USE THE BEST CARBON PAPER. Our "Klear-Kopy" carbon gives clear, unsmudged copies of your letters and other documents. It has been selected by a leading government against 43 competitors. "Peerless" typewriter ribbons give clear letters and will not clog the type. Sold by all dealers. Write us for samples. Peerless Carbon and Ribbon Co., Toronto. (tf)

WANTED—A splendid opportunity for dealers to handle the best combination Duplicating, Addressing and Office Printing Machine on the market. Exclusive territory. Send name and address, giving occupation and references, to the Canadian Writerpress Company, Ltd., 33 John St., Hamilton, Ont. (tf)

WE HAVE eight rebuilt Visible Oliver Typewriters for sale. The price is $30.00 each, and at that figure they are a bargain and should not be on the market long. Monthly payments can be arranged if desired. The Monarch Typewriter Company, Limited 98 King W., Toronto.

WHEN buying bookcases insist on having the best on the market—"Macey Sectional Bookcases." Carried in stock by all up-to-date furniture dealers. Illustrated booklet sent free on request. Canada Furniture Manufacturers, Limited. General offices, Woodstock, Ont. (tf)

YOU can display your goods to better advantage through the use of up-to-date fixtures. We are specialists in the planning of stores and offices. Our catalogue contains illustrations of many new features and several handsomely equipped stores and offices. Shall we send you our catalogue "J?" Jones Bros. & Co., Ltd., 30-32 Adelaide St. West, Toronto. (tf)

YOU don't buy a National Cash Register—it pays for itself. Saves money. Prevents mistakes. We can prove it. National Cash Register Co., 285 Yonge Street, Toronto.

YOU need the best possible protection from fire! If your valuables are in one of our safes you can rest at ease; no fire is too hot for our safes and vaults to withstand. We manufacture vaults and safes to meet every possible requirement. Write for catalogue "S." The Goldie & McCulloch Co., Ltd, Galt, Ont. (tf)

$75 buys the best Duplicating Machine on the market. ACME will print anything a job printer can do. Complete outfit. Acme Duplicating Machine; one tubular stand, fitted with type cases, compartments plainly lettered and arranged like universal keyboard of the standard make of typewriters; one drawer for accessories and forms; 20-lb. font of typewriter type, one chase, one Acme ribbon any color with typewriter ribbon to match, one pair tweezers, two quoins, one key, one oil can, and one set of reglets. Sold with a guarantee. Acme Duplicator Co., Baltimore, Md., U.S.A. (tf)

## TRAVELER WANTED.

WANTED—First class A1 energetic salesman for a well established Toronto firm dealing in engineering, electrical and mill supplies. Man must be familiar with office routine and management, and have sufficient executive ability to eventually take the position of sales manager. State age, experience and salary expected. Apply Box 96, THE POWER HOUSE, 10 Front St. East, Toronto. (12tf)

## WANTED.

MEN selling on commission, or men whose time is not fully employed, should become our agents. The Canadian Grocer, Dry Goods Review, Hardware and Metal, Printer and Publisher, Bookseller and Stationer, Plumber and Steamfitter, Canadian Machinery and Power House are all well known and highly regarded trade papers, with a large circulation throughout Canada, United States and Great Britain. The circulation must be maintained and increased. We pay large commissions to men who push for new subscribers. If you can do anything in this way write the Circulation Department, giving references. The MacLean Publishing Co., Toronto.

# ALPHABETICAL INDEX TO ADVERTISERS


**A**

Alhany Steam Trap Co ..... 14
Allis-Chalmers-Bullock ..... inside front cover
Armstrong Mfg. Co ..... 53
Audel, Theo., & Co ..... 19

**B**

Babcock & Wilcox ..... 54
Bain & Mitchell ..... 59
Beaubien, De Gaspe ..... 59
Brownell Co ..... 3
Buchanan, R. H., & Co ..... 53
Buffalo Mechanical and Elec. Lab ..... 53
Butterworth Foundry Co ..... 4

**C**

Canada Metal Co ..... 8
Canadian Assn. Stationary Engineers ..... 16
Canadian Oil and Waste Saving Machine Co ..... 19
Canadian Westinghouse Co ..... 64
Chapman & Walker, Limited ..... 62
Cling-Surface Co ..... 10
Colonial Engineering Co ..... 61
Corbet Foundry & Machine Co ..... 18
Curtis & Curtis ..... 53

**D**

Darling Bros ..... 14
Dart Union Co ..... 6
Death & Watson ..... 59
Detroit Leather Specialty Co ..... 11
Devine, J. P., Co ..... 60
Diamond Grate Bar Co ..... 4
Diamond Power Specialty Co ..... 7
Dietrich, W. N ..... 59

**E**

Electrical Maintenance & Repair Co .... inside back cover
Electric Boiler Compound Co ..... 15
Engineers' Equipment Co ..... 53

**F**

Farmer, John T ..... 59
Fetherstonhaugh ..... 59
Francis, Walter J ..... 59
Frew, J. F ..... 59

**G**

Galt & Smith ..... 59
Garde, John, & Co ..... 53
Goldie & McCulloch Co ..... 20
Goodhue, J. L., & Co ..... 12
Goold, Shapley & Muir ..... 9

**H**

Hawkins, W. T., & Co ..... 18
Hercules Float Works ..... 53
Hill Electric Switch Co ..... 18
Hoffman, G. W ..... 53
Hoffman, Jules G ..... 8
Hygienic Laboratories ..... 1

**I**

Ideal Steam Separator & Supply Co ..... 9

**J**

Jacobs, Chas., & Co ..... 62
Jenckes Machine Co ..... 3
Jenkins Bros ..... 6
Johnson, F. M. G ..... 59
Jones & Moore Electric Co ..... 53
Jones Underfeed Stoker Co ..... 16

**K**

Kerr Engine Co ..... 9
Kilmer, Pullen & Burnham ..... inside back cover

**L**

Liberty Mfg. Co ..... 51
Linde British Refrigeration Co ..... 18
Lunkenheimer Co ..... 3

**Mc**

McArthur, J. D ..... 12
McGhie, W. C ..... 18
McLaren, D. K., Ltd ..... 13
McLeod & Henry Co ..... 17
McRae, J. B ..... 59

**M**

Merrill, Edward B ..... 59
Michigan Lubricator Co ..... 11
Mitchell, C. H & P. H ..... 59
Moore & Scollan ..... 59
Morehead Mfg. Co ..... 5
Morrison Brass Mfg. Co., Ltd., Jas ..... outside back cover

**N**

National Pipe Bending Co ..... 5
Nichols Chemical Co ..... 17
Northern Electric and Mfg. Co ..... 60

**P**

Packard Electric Co., Ltd ..... 63
Peiler & MacKenzie ..... 14
Penberthy Injector Co., Ltd ..... outside front cover
Petrie, H. W ..... 54
Pierce, Wm. B ..... 17
Polson Iron Works ..... 2

**R**

Riblet Heater Co ..... 7
Rohb Engineering Co ..... 19
Robertson, J. M ..... 59
Russel & Gifford ..... 5
Royce, G. C ..... 63

**S**

Sadler & Haworth ..... 12
Sammett, M. A ..... 59
Shanly, J. M ..... 59
Sight Feed Oil Pump Co ..... 15
Snowdon, C. C ..... 8
Sterling Lubricator Co ..... 15

**T**

Turbo-Blower Co ..... 7

**V**

Vilter Mfg. Co ..... 18

**W**

Waterous Engine Works Co ..... 1
Williams, Madison, Co ..... 16
Wilson, J. C., & Co ..... 59

**Y**

Youle, C. B ..... 59

# MACHINERY WANTED AND FOR SALE

## Rates for Condensed Advertising

Advertisements of "Machinery Wanted" or "For Sale" will be inserted in this Department at the rate of 12 cents per line each insertion, on the basis of 14 lines to the inch, payable in advance. A liberal discount will be given when a contract is placed for any amount over 100 lines to be used in 12 months. Write for rate card.

Advertisements of Employment or Help Wanted will be inserted at the rate of one cent per word each insertion, payable in advance.

Advertisements must be received not later than the 7th of each month to insure insertion in current issue.

### For Sale

Nine Horse Power New Campbell Oil Engine, Electric Lighting type; cheap; most economical engine for small plant. Jones & Glassco, Montreal. (tf)

### For Sale

One Return Tubular Boiler, 4' x 12'.
One Stationary Slide Valve Engine, 12" x 16".
One Stationary Slide Valve Engine, 9" x 12".
One Stationary Slide Valve Engine, 6" x 10".
One Belt Driven Feed Pump, 1½" connections.
Write for prices to Corbet Foundry and Machine Co., Owen Sound.

### For Sale

FOR SALE CHEAP FOR CASH—One 15 h.p. horizontal engine, second hand, made by F. Lowe & Sons, Ottawa. Apply to Marshall Rothwell, P O. Box 1, Navan, Ont. (10)

### For Sale

FOR SALE or will grant exclusive right to manufacture on royalty Canadian Patent 115643 a necessary household article simple to make. Arthur Solomon, 211 Winslow Ave. Buffalo, N.Y. (11)

### For Sale

Machinery for Sale—1 2nd hand 5½ h.p. vertical boiler and engine, cast iron base supporting same, all in A1 condition.

1 11 h.p. gas engine, 2nd hand, fitted with magneto, and in first-class condition.

25 2 h.p. new horizontal gasoline pumping and power engines combined, capacity 25 barrels per hour, elevated 100 ft.; also 5 h.p. new gasoline vertical power engines, suitable for boat or launch.

Address J. D. ANDERSON, Machinist and Engineer, Box 203, Windsor, Ont.

### For Sale

2 60-in. x 14 feet boilers—74 3-in. tubes.

2 single cold water pumps.

The McGREGOR-GOURLAY CO., Limited, Galt, Ontario.

### For Sale

One Warren Generator, 150 K.W. single phase, 133 cycles, 2200 volts, 800 speed, complete with Exciter and Switchboard; only in use one year. For further information apply to

S. T. KELLY, City Electrician,
(tf) Strathcona, Alberta

### For Sale

HORIZONTAL TUBULAR BOILERS—36" x 12,' 48" x 11' 6," 48" x 12,' 48" x 14,' 54" x 12, 60" x 14.'

FITZGIBBONTYPE PORTABLE BOILERS—7' each, 60 h.p.

HORINE WATER TUBE BOILER—70 h.p.

2 LARGE MARINE WATER TUBE BOILERS, suitable for tugs or steamers, and good for 150 pounds steam.

NEW BROWN AUTOMATIC ENGINE—11 x 30.

For full particulars address Polson Iron Works, Limited, Toronto.

### For Sale

Thoroughly Refitted Ingersoll-Sargeant Straight Line Air Compressor, 10¼" x 12" stroke; belt drive, class B; complete with all fittings and fitted with Sargeant automatic regulator and unloading device; in use about five years.

Second-hand 9 x 10 Stationary Engine, centre crank, Waterous make.

The Waterloo Manufacturing Co., Limited, Waterloo, Ontario.

### Electric Lighting

THE town of North Battleford, Saskatchewan, the chief divisional point on the main line of the Canadian Northern Railway is open to grant a franchise for electric lighting. Address, J. A. Gregory, Mayor.

### For Sale

FOR SALE—12 h.p. refitted horizontal steam engine. Barkey Bros., Stouffville, Ont.

### For Sale

FOR SALE—12 x 12 McEwen engine, rated 100 h.p.; very little used. The Berlin Light Commissioners.

### For Sale

PUMPS—6" and 8" centrifugal pumps; 1 8" centrifugal pump, with engine; 1 12 x 12 double cylinder power vacuum pump; 2 6" centrifugal pumps, second hand. Waterous Engine Works Co., Ltd., Brantford.

### Position Wanted

AS ENGINEER—Eight years experience as fireman and engineer in stationary plant, 2½ years on steamer. Also four years experience at steamfitting. Hold Ontario certificate and I.C.S. diploma. References as to character and ability. Box 11, POWER HOUSE, 10 Front Street East, Toronto. (7)

### For Sale

One Westinghouse Generator, 54 k.w. Direct current, 125 volts, speed 850, complete with switchboard, instruments, etc. Rest of order. Will sell reasonable. Mr. Taber, 444 Bathurst St., Toronto. (8)

### For Sale

Two Fitzgibbon Boilers for sale at a bargain. Are now carrying 70 lb pressure. Would make splendid heating boilers. G. C. Mooring, 16 Pearl Street, Toronto. (9)

### For Sale

ONE 5 h.p. Cook vertical gasoline engine, double ignition, complete with tank, skids, and all accessories. A new engine at a bargain for quick sale. Kellogg & Co., 196 King St. West, Toronto.

### For Sale

Electric Motors One 5 horse-power re-wound this year; also one single horse-power, slightly used; both direct current. Apply Box 93, POWER HOUSE, Toronto. (12)

### For Sale

2 250 k.w. M.P 6, 550 volt Wghse. belted generators.
1 150 k.w. M P.6, 250 volt Crocker-Wheeler generator.
1 75 k.w. M.P 4, 125 volt, G E. generator.
2 60 k.w 125 volt Edison bipolar generators.
1 40 k w. M.P.6, 250 volt, G.E. generator.
1 125 lt 6.8 amp. Ft. Wayne arc generator.
1 120 lt. 6.8 amp. W.E. arc generator.
1 100 lt. 9.6 amp Brush arc generator.

We have many more. Send us your requirements.

NATIONAL MACHINERY AND WRECKING CO.,
1916 Scranton Road, Cleveland, Ohio.

### For Sale

The following slightly used, second-hand, direct current machinery, in good repair—

1 200 light multipolar, Jones & Moore, 110 volts.
1 75 light bipolar, Jones & Moore, 110 volts.
1 200 light multipolar, Kay, 110 volts.
1 25 light multipolar Kay, 110 volts.
1 3 k.w. Edison bipolar dynamo, 110 volts
2 7½ h.p., 250 volts, bipolar T. & H. motor.
2 5 h.p., 250 volts, bipolar T. & H motor.
5 1 h.p., 250 volts, bipolar T. & H. motor.

For prices and information address

T. & H. ELECTRIC CO., Hamilton, Ontario.

### SOMETHING THAT WILL INTEREST YOU

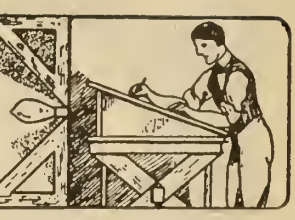
¶ Have you any second-hand machinery, such as a boiler, engine, pump, etc., around your plant which could be turned into cash?

¶ This department is designed to bring buyer and seller together. Somewhere in Canada is a man who may be looking for just what you have to sell. It may be in the next town, or at the other end of the province.

¶ Make up a list of what you have for sale and send it to us for our next issue. After one trial you will be convinced of the efficiency of this department.

**THE POWER HOUSE**
**10 Front St. East, TORONTO**

# PROFESSIONAL DIRECTORY




**WALTER J. FRANCIS, C. E.**
CONSULTING ENGINEER
SOVEREIGN BANK BUILDING
MONTREAL
MEMBER CANADIAN SOCIETY CIVIL ENGINEERS.
MEMBER AMERICAN SOCIETY CIVIL ENGINEERS.

N. P. F. Death, B.A.Sc. Assoc. A.I.E.E. — L. Watson, Assoc. A.I.E.E.
**DEATH & WATSON**
Electrical Engineers and Contractors
Experts in illumination. Lighting systems designed and installed. Manufacturers of all kinds of Electric Signs for advertising purposes.
M. 1541. 25 Jarvis St., Toronto, Canada

*B. Sc., (McGill) A.s. M.C.S.C.E., Ass. M.A.I.E.E.*
**DE GASPÉ BEAUBIEN**
CONSULTING ELECTRICAL ENGINEER.
Liverpool London and Globe Bldg.,
MONTREAL

**J. M. SHANLY**
M. Can. Soc. C. E. — M. Am. Soc. C. E.
CIVIL ENGINEER
RAILWAYS, BRIDGES, FOUNDATIONS, HYDRAULIC WORKS.
Room 310, Board of Trade, MONTREAL

**EDWARD B. MERRILL**
B.A., B.A. Sc., Mem. Can. Soc.C.E., Mem. A.I.E.E.
ENGINEER
Power Developments and Transmission. Electric Lighting, Electric Railways. Municipal Engineering, Industrial Plants, Reports, Valuations, Etc.
LAWLOR BUILDING, TORONTO, AND 305 FORT ST., WINNIPEG.

**J. M. ROBERTSON, LIMITED**
CONSULTING ENGINEERS
Mechanical, Electrical, Hydraulic, Steam, Gas.
Plans, Specifications, Estimates, Tests, Reports and Supervision.
Suite 101, Board of Trade Bldg, Montreal, Que.

**JOHN B. McRAE**
Consulting Engineer
Citizen B'ld'g. — OTTAWA, CAN.

**JOHN T. FARMER**
Mechanical and Hydraulic Engineer
Green Fuel Economizer
Mechanical Draft Apparatus
427 Coristine Bldg., MONTREAL
Write for Catalogue P.

**M. A. SAMMETT**
Consulting Electrical Engineer
Estimates, Reports, Specifications, and Supervision of Electric Lighting and Power Plants.
Telephone Main 6737 East 5327 — 702 Canadian Express Bldg., MONTREAL

**CHARLES H. MITCHELL**
**PERCIVAL H. MITCHELL**
Consulting and Supervising Engineers
Hydraulic, Steam and Electric Power Plants. Industrial, Electrical & Municipal Engineering
TRADERS BANK BUILDING, TORONTO

**Fetherstonhaugh & Co.**
**Patents** Trade Marks and Designs in all countries
Canada Life Bldg., MONTREAL

**W. N. DIETRICH**
ELECTRICAL AND MECHANICAL ENGINEER
16 St. Sacrament Street, Montreal
CONSULTING AND CONTRACTING
Supervision, Specifications, Plans, Tests, Reports, Etc.

HARRY A. MOORE — JOHN J. SCOLLAN
**MOORE & SCOLLAN**
ELECTRICAL AND MECHANICAL ENGINEERS
STEAM, ELECTRIC AND HYDRAULIC POWER
CONSULTATION, REPORTS, ESTIMATES, PLANS, CONSTRUCTION, TESTING, ETC.
OFFICES: GUARANTEE BLDG., 43 KING ST. W.
TELEPHONE MAIN 445 — TORONTO, CAN.

**F. M. G. JOHNSON,**
PH.D. (Breslau) M.Sc. (McGill) F.I.C. (London)
Consulting and Analytical Chemist
Analysis of Boiler Feed Waters, Iron, Steel, Oils, Coals, etc.
E. T. BANK BUILDING, MONTREAL.
PHONE MAIN 27.6

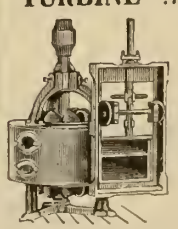
**GALT & SMITH**
Civil and Sanitary Engineers.
Water Supply, Sewage and Sewage Disposal
Examinations and Reports
23 Jordan Street — Toronto

**EXPERTS**
ON
SMOKE PREVENTION
AND
BOILER ROOM EQUIPMENT
Canadian Representatives:
The TRIUMPH STOKER, Leeds, Eng.
CONSULTING ENGINEERS
Steam Hydraulic Mechanical
**BAIN & MITCHELL,**
Y.M.C.A. Building, MONTREAL

**C. S. YOULE**
A.M.I.E.E. — A.M.I.M.E.
Electrical and Mechanical Consulting Engineer
Five Sisters Block, VICTORIA, B.C.

**J. F. FREW**
Assoc. M. Inst. C.E.
Civil and Mechanical Engineer
Phone 4698 Room 19, Fairfield Building, Vancouver, B.C.

Improved "LITTLE GIANT" TURBINE WATER WHEEL



Complete in self-contained case. No expensive flume required. 18 sizes carried in stock, prompt shipment insured. High test efficiency at full or partial gate opening.
Construction, acme of simplicity.
Unequalled durability.
Write for descriptive catalog.
**J. C. Wilson & Co.**
GLENORA, ONT.
Builders of Power Transmission Machinery
Machine Cut Wood and Iron Tooth Gearing our specialty

## PERFECT INSULATION

of Electric Coils, Cables, etc., is dependent upon a perfect system of drying and impregnating.

The Emil
PASSBURG SYSTEM
of Vacuum Drying and Impregnating

is the most satisfactory and economical process yet discovered. We manufacture all sizes and types.

Write for our Descriptive Catalogue.

**J. P. Devine Company**
BUFFALO N. Y.

POWER USERS, ENGINEERS OR CENTRAL STATION MEN wanting the name and address of the manufacturer of any class of power equipment, whether for steam, gas, or electric plants, will be able to obtain same by writing to the Editor of this journal. .:. .:. .:. .:.

Save Time in the Giving and Receiving of Orders

# Northern Electric Intercommunicating Telephones Will Do This For You

BECAUSE

You get instant communication between departments.
You have provision for emergencies.
You can be everywhere at once.
You have complete control of your entire plant.
Backed by our 30 years' experience and the most liberal guarantee.
Our experts are at your service—Don't put up any longer with unhealthy speaking tubes.

Northern Electric Intercommunicating telephones are simple in operation—reliable in service and inexpensive of installation.

Write for Bulletin 3113.

## THE NORTHERN ELECTRIC AND MANUFACTURING CO. LIMITED

Manufacturers and Suppliers of all apparatus and equipment used in the construction, operation and maintenance of Telephone and Power Plants

| MONTREAL | TORONTO | REGINA | WINNIPEG | VANCOUVER |
|---|---|---|---|---|
| Cor. Notre Dame and Guy Sts. | 60 Front St. W. | | 559 Henry Ave. | 918 Pender St. West |

# GAS ENGINE PUMPING vs. HIGH DUTY STEAM PUMPS

**BY L. C. READ, ME., A., MEM. C.S.C.E.**

IT IS NOW very generally conceded by the engineering fraternity that gas engines have come to stay: indeed, in no branch of applied science has anything like a corresponding advance been made during so short a space of time as in the design and efficiency of the prime mover.

A few years ago the internal combustion engine occupied a small field consisting of small units—doing work of small importance, and was not even considered eligible to take the place of an ordinary non-condensing simple steam engine in driving an ordinary ten-hour-per-day factory load. To-day the ten-hour factory load is among the least of its marvellous accomplishments. To-day there is no kind of duty so sensitive, so irregular, or so large that it does not successfully perform.

In paper mills, textile mills, flour mills, cement mills, and central generating stations it has not only proved its own reliability, but has maintained its unchallenged superiority over the best performances of steam engines in points of fuel consumption per b.h.p. hour, and now it has entered the field of pumping—the field in which steam engines have attained their most brilliant results. It enters this important field, too, not to compete for honors merely against the direct-acting non-fly-wheel make of steam pump, but against the steam pump's "Champion" unit—*the high duty type.*

With perhaps less than a dozen exceptions, there is not a pumping unit on this continent which is averaging, under ordinary daily working conditions, more than one hundred millions of foot pounds duty per hundred pounds of coal, and it is safe to say that the *average* foot pound duty—among the municipal pumping plants: that is to say, taking the *best* average—will fall far below *seventy-five* millions.

Without going into the reasons—the inherent inefficiencies of a steam plant, whether it be pumping, or any other duty, the universally conceded difficulty of maintaining the efficiency of a steam plant under ordinary daily working conditions, etc.—let us compare the showing which a suction gas-engine pump is prepared to make, against a high-duty steam pump.

To begin with—it must be remembered that the results obtained with the steam pump under *expert test* and the results shown under *daily working conditions* are vastly different—for the reason that its overall economy depends mainly upon its boiler evaporative efficiency and it is needless to dwell upon the fact that whereas, under expert handling, with all surfaces clean and with proper draft pressure, an evaporation of ten pounds of water per pound of coal may be obtained, this evaporation falls off rapidly under ordinary daily working conditions, and as against which the suction gas engine—having no surfaces to become foul, no varying draft pressure, not depending upon evaporative efficiency, stoking or any of the many other separated elements of the steam plant, maintains its expert results automatically and continuously. And it must be particularly borne in mind that guarantees obtainable on high-duty steam pumps are invariably based upon a given foot pound duty *"per thousand pounds of dry steam"* —without regard to the amount of coal which *may* have to be burned in order to supply the "thousand pounds of dry steam," and that the actual yearly coal economy is 35 to 50 per cent. below the usually advertised results. As against this a guarantee is given on the gas engine based upon a given foot pound duty *per hundred pounds of coal* and covering a period of an entire year's run, thus leaving no doubt as to over-all results or as to its continued economy.

The Hornsby-Stockport gas engine has demonstrated—in many installations in Canada—that, under continuous ordinary daily working conditions, a fuel economy of less than one pound of Pennsylvania anthracite pea coal per b.h.p. hour is obtained, that is to say, it delivers on the engine shaft 33,000 foot pounds × 60 minutes = 1,980,000 foot pounds per hour per pound of coal, or 198,000,000 foot pounds per hour 100 *pounds* of coal.

Should this engine, therefore, be direct coupled to a multiple-throw pump with an overall efficiency of say 80 per cent., then the combined efficiency would be 198,000,000 × 80 per cent. or a foot pound duty of 158,400,000 per 100 pounds of coal. Using a clean anthracite pea coal (such as is easily obtainable in the Canadian market) at a cost of say $5.00 per ton and pumping against a head of 100 feet—including suction lift—this gas engine has to its credit the phenomenal economy of 22.5 cents fuel cost per 158,400,000 foot pounds duty—net! or, expressed in terms representing daily working conditions, would pump *one hundred and fifty-eight thousand four hundred Imperial gallons per hour, against* 100 *feet head, for a total fuel cost of only* 22½ *cents,* or 3,800,000 gallons per 24 hours for a total fuel cost of only $5.40—enough water to supply a city of 30,000 population and with 800,000 gallons per day as a margin. 3,800,000 gallons of water per day for a fuel cost of only $5.40 being equal to only $1.42 per million gallons per day!

It is perfectly safe to say that—with two, possibly three exceptions—there is not a town in the entire Dominion but what its fuel cost for pumping is from three to ten times this cost. And the above figures represent, by no means, the *best* this gas engine can do. They represent an economy which is easily obtainable with small units—say down to 50 b.h.p.

As a matter of fact, in the larger units, say from 250 to 1,000 b.h.p.—a fuel consumption is easily shown of .8 of a pound of coal per b.h.p. hour. Taking, then, the pump efficiency still at 80 per cent., the result would be $\frac{158,400,000}{.8}$ = 198,000,000 foot pounds per 100 pounds of coal or a fuel cost of only $1.14 per million gallons against 100 feet head.

No steam pumping unit—though it be of the best design, equipped with the most refined auxiliaries, and operated under the most ideal conditions, can approach such results! Furthermore, this gas engine can be attached to a turbine pump—a pump which is the acme of simplicity—by means of the famous Wust Double Helical Speed Increasing Gear —a gear which, like the gas engine has recently forced its own merit upon a doubting public—and show results which, under ordinary daily working conditions, are rarely equalled even by the best modern high-duty steam pumps.

Taking one pound of five dollar coal for the gas engine per b.h.p. hour, 97 per cent. efficiency for the gear and a turbine pump efficiency of say 68 per cent., the result (with ample margin of safety) is 33,000 × 60 × 100 × 97 per cent. × 68 per cent. = *over* 130,000,000 *foot pounds duty per* 100 *pounds of coal.*

Very shortly a demonstration Gas Engine Pumping Set will be installed in Montreal for the purpose of Permanent Exhibition by

**The Colonial Engineering Co.,**

***Gas Power Engineers and Contractors*** ***Limited***

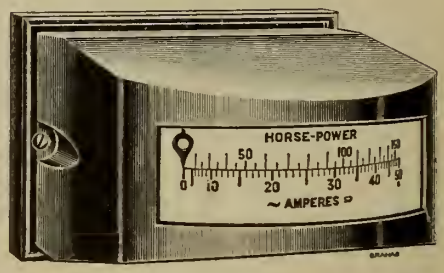
***222-224 St. James St. - MONTREAL***

# A.C. and D.C. AMMETERS and VOLTMETERS

## Direct Reading, Recording and Portable

WRITE FOR OUR NEW PRICES

OUR NEW PRICES ARE RIGHT

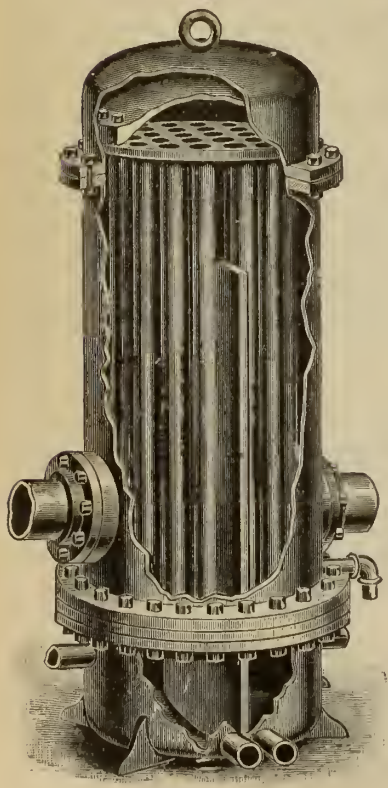



We Invite Your Inquiries.

# CHAPMAN & WALKER

LIMITED

CORNER VICTORIA AND LOMBARD STREETS --- TORONTO



## A Feed Water Heater that is Absolutely Guaranteed

### THE JACOBS HEATER

is made to last long after the question of price has been forgotten. The construction allows free and unrestricted expansion in every part, eliminating rupture and leaky joints.

### NO SEDIMENT TROUBLES

Note the TWO Blow Off Pipes in the base.

### UNBREAKABLE CONSTRUCTION

made with a cast iron shell that will never wear out. No trouble from pitting or corrosion around rivets, as there are none. No pitting of the shell as occurs in steel or wrought iron construction.

Fully machined, carefully made and absolutely guaranteed.

GET OUR PRICES

## CHAS. JACOBS & CO.

42 OLIVER STREET - - BOSTON, MASS.

## The Lowden Patent Automatic Water Separator

# Packard TUNGSTEN LAMPS

THE MOST LIGHT FOR
THE LEAST MONEY

## The PACKARD ELECTRIC CO., Limited

Head Office and Works, - - - - - - - - ST. CATHARINES, ONT.
Branch Offices, - - - - - - - - - MONTREAL and WINNIPEG

# FERRANTI METERS

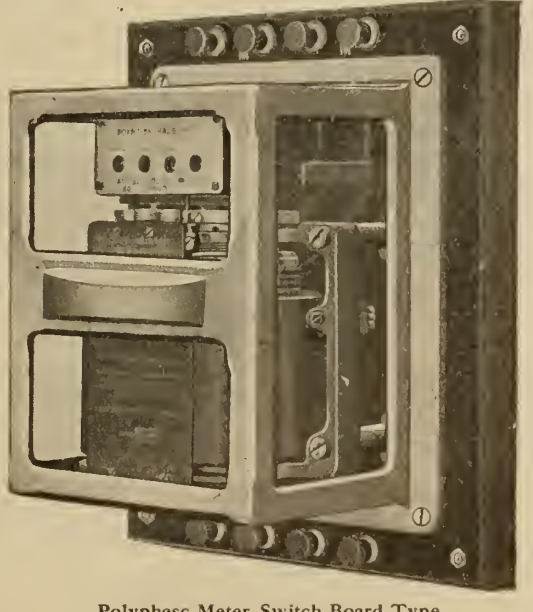
ALL TYPES
For A.C. & D.C. Currents

COMPLETE SWITCH BOARDS AND APPLIANCES

The Ferranti Meter fills all requirements.

Are known and sold the world over.

Remember, we manufacture a full and complete line of Switch Board Instruments, also furnish complete Boards, both High and Low Tension. : : : : :



Polyphase Meter, Switch Board Type

The Ferranti Leads!
"Why"?

It has a low starting current, accurate from 1/20 to 50% overload.

It has a low shunt loss.

No wear nor friction.

Send for our prices before purchasing. They will interest you.

Western Sales Office:
603 UNION BANK BUILDING, WINNIPEG
G. A. POWELL, Representative

Canadian Manager: G. C. ROYCE
22 Dundas St., WEST TORONTO

# Canadian Westinghouse Company

LIMITED

## Hamilton, Canada

## ELECTRICAL APPARATUS

**Motors, Generators, Transformers, Switchboards, Etc.**

## AIR BRAKE APPARATUS

**For Steam and Electric Railways**

## COMPRESSORS FOR INDUSTRIAL SERVICE

**Steam, Motor and Belt Driven, Stationary and Portable**

**DISTRICT OFFICES**

**VANCOUVER** **WINNIPEG**

**TORONTO** **MONTREAL** **HALIFAX**

# Now, Confound That Machine!

## We're going to be shut down now, good and plenty.

That's where you're wrong, old man. Make a jump for the Phone, call up MAIN 3419, TORONTO, tell us your particular Brand of Trouble and we'll shoot a man at you, with supplies before you're through talking.

Just Make a Note of it.

WE REWIND ARMATURES
FIELDS
ROTORS
STATORS
TRANSFORMERS

BUILD NEW COMMUTATORS
SWITCHBOARDS
SOLENOID SWITCHES and CONTROLS

REPAIR and OVERHAUL ANYTHING
ELECTRICAL
ALTERNATING or DIRECT CURRENT
STATION, MANUFACTURING or CAR EQUIPMENT

The Specialists in Treatment of Electrical Diseases.

## The Electrical Maintenance & Repairs Co.

Phone, Main 3419 162 Adelaide Street West

Toronto

Note:—Enquirers will greatly oblige by mentioning this Ad.

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

TRADE MARK J.M.T. REGISTERED A GUARANTEE OF QUALITY

***Thousands of Dollars are Saved***

every year by the wise selection of RELIABLE Steam Goods.

The good engineer knows it to be false economy to instal such goods because they're cheap. Usually they waste steam or cause trouble and annoyance. The effect not always lasting for a day only, but frequently is allowed to continue for weeks, each succeeding week increasing the loss sustained by the user.

***Full Weight and Substantially Made Goods Pay***

***The Kind We Make***

Valves of All Kinds in Iron and Brass

Iron and Brass Cocks—Steam, Marine and Asbestos Packed

J. M. T. Improved Y Blow-off Valve, with renewable seat

Steam, Vacuum and Combination Gauges

Revolution Counters

Engineers' Clocks

Improved Recording Gauges

Steam and Hot Water Thermometers

# Engineers' Supplies

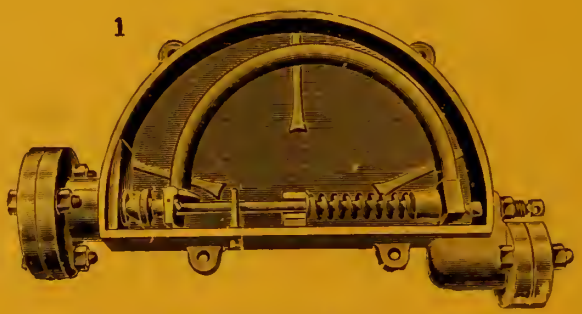
## and Steam Specialties

*Improved*

***J.M.T. Injector***

operates under the widest range of pressures.

SIMPLE
EFFICIENT
RELIABLE



***The "HEINTZ" Steam Saver***

Controlled by temperature, operates under any pressure, can be placed in any convenient location, contains few parts which are easily accessible to.

The ***Heintz Trap*** combines great efficiency and durability, has large capacity and operates at a variation at one degree of temperature.

*Booklet upon request*

***J.M.T. Valves***

They require no introduction. Used anywhere where a good valve is required.

## The JAMES MORRISON BRASS MFG. CO., Limited

**93-97 Adelaide Street West** **TORONTO**